THE EFFECT OF BIOFEEDBACK INTERVENTION PROGRAM ON ANXIETY AMONG ENGINEERING STUDENTS AT UNIVERSITI MALAYSIA PAHANG

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DOCTOR OF PHILOSOPHY

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Thesis submitted in fulfilment of the requirements

for the award of the degree of

Doctor of Philosophy in Technology Management

Faculty of Technology

UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2011

SUPERVISOR'S DECLARATION

We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Doctor of Philosophy in Technology Management.

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ACKNOWLEDGMENT

I am so blessed to have such a strong support system in my life, especially during these past three years. It has been an incredible journey, one that I could not have done without the support of my parents, family, colleagues, supervisors, and friends. First of all, many thanks to Allah ta'ala for always blessing my life and my supervisors (Assoc. Prof. Dr. Muhammad Nubli Abdul Wahab, Prof. Dr. Ahmad Othman, and Dr. Mohd Ghani Awang) I am indebted to you for your unwavering guidance and help to complete my study. I am so appreciative of the awesome support, Dr Tutut Herawan, you believed in writing and publishing the idea, I am eternally grateful. And Auditya Purwandini Sutarto for your motivation, Thank you for offering your depth of expertise and constant encouragement. Finally, I am forever thankful to my beloved parents Drs H. Purwadi and Hj Tri Suwarti, my family, and friends for their ongoing support, genuine interest in my work, and unconditional love. Without all of you constantly challenging me and supporting me, my feet would have never left the ground. Lastly, I said ***Alhamdulillahi rabbil 'alamin*** *.*

Abstract

Anxiety is a major predictor of students' academic performance. High anxiety level has negative effects on their academic performance. Previous research has reported that many university students faced anxieties while undergoing their studies but did not receive adequate intervention program to reduce their study anxiety. Researchers also reported that biofeedback training has been proven to significantly reduce anxiety among individuals. This study was designed to explore anxiety problems faced by university students, and it employs pre post design to compare between groups. It also incorporates biofeedback training in the intervention program in reducing study anxiety for the improvement of students' academic performance. The training group were exposed to ten sessions of training but no intervention was given to the non-training group. Data collection is through a random survey, and the results are used to identify the study anxiety sources among the students. A total 770 engineering students were involved in the survey, while 205 students sat for the correlation test, and 70 students participated in the biofeedback training. The quantitative analysis was used to find significant effect of the intervention program. Study anxiety as an independent variable was measured by physiological arousal and cognitive anxiety. The academic performance uses grade point average (GPA) as a dependent variable. From the survey, seven significant sources of study anxiety were found: examination anxiety (the major source), social anxiety, presentation anxiety, mathematics anxiety, language anxiety, family anxiety, and library anxiety. Using Pearson correlation, a significant correlation between high level anxiety and low academic performance was found, with a small coefficient correlation (r = -.264; p = .000). Results of repeated measure indicated significant differences across 4 sessions in physiological arousal among training group. Using Paired t-test revealed that the training group showed significant reduced on all physiological and cognitive measures while not significant on all measures for non training group. For academic performance, both groups show significant improvement, with p = .000 for the training group and p = .001 for the non-training group. However, as for academic improvement, the training group showed a 25% improvement compared to 7% improvement for the non-training group. Based on the self-evaluation results, the participants in the training group achieved the following positive effects from the training: feel more relaxed and calm, more confident, reduced heartbeat rates, improved breathing techniques, improved study skills, better time management, increased concentration, and improved overall well being. In conclusion, the biofeedback intervention program is definitely effective in helping students reduce their study anxiety in improving academic performance. In addition, the study supported the Catastrophe model to examine the effect of biofeedback intervention program in reducing anxiety for the improvement academic performance.

Abstrak

Tahap kegelisahan di kalangan pelajar adalah satu peramal utama prestasi akademik. Tahap kegelisahan yang tinggi memberi kesan negative terhadap prestasi akademik mereka. Kajian sebelum ini melaporkan ramai di kalangan pelajar mengalami kegelisahan semasa mengikuti pengajian di universiti, namun mereka tidak menerima program intervensi yang mencukupi untuk mengurangkan kegelisahan dalam menjalani pengajian mereka. Para pengkaji juga telah mengesahkan tahap kegelisahan di kalangan individu boleh dikurangkan dengan ketara melalui latihan "biofeedback". Kajian ini direkabentuk untuk mengenalpasti masalah kegelisahan di kalangan pelajar universiti, dan ia menggunakan rekabentuk pre post untuk membuat perbandingan di antara dua kumpulan. Ia juga menggabungkan teknik latihan "biofeedback" intervensi program untuk mengurangkan tahap kegelisahan dan seterusnya meningkatkan prestasi akademik pelajar. Ahli kumpulan-dilatih didedah dengan sepuluh sesi program intervensi tetapi ahli kumpulan-tak-dilatih tidak melalui apa-apa program intervensi. Pengumpulan data dilakukan melalui satu kajian rawak, di mana hasilnya digunakan untuk mengenalpasti punca utama kegelisahan pengajian di kalangan pelajar. Sejumlah 770 pelajar terlibat di dalam kajian; dari jumlah tersebut, seramai 205 pelajar menduduki ujian korelasi, manakala 70 pelajar mengambil bahagian di dalam latihan "biofeedback". Analisis kuantitatif digunakan untuk mendapatkan kesan signifikan program intervensi. Kegelisahan pengajian sebagai pembolehubah bebas diukur dengan bangkitan fisiologi dan kegelisahan kognitif. Pembolehubah bersandar "Grade point average" (GPA) digunakan untuk mengukur prestasi akademik pelajar. Hasil kajian mendapati tujuh punca signifikan yang menyebabkan kegelisahan pengajian di kalangan pelajar: kegelisahan peperiksaan (punca paling utama), kegelisahan sosial, kegelisahan pembentangan, kegelisahan matematik, kegelisahan bahasa, kegelisahan famili, dan kegelisahan perpustakaan. Dengan menggunakan korelasi Pearson, terdapat korelasi signifikan di antara kegelisahan tahap tinggi dan prestasi akademik rendah, dengan pekali korelasi yang kecil (r = -.264; p = .000). Teknik ukuran-berulang ANOVA menghasilkan perbezaan signifikan dalam perubahan pada 4 masa bagi bangkitan fisiologi dan kegelisahan kognitif di kalangan kumpulan-dilatih. Sampel-berpasang t-test pula didapati bahawa kumpulan dilatih menunjukkan signifikan pengurangan pada semua pengukuran fisiologi dan kognitif sedangkan tak signifikan pada semua pengukuran dikalangan kumpulan tak-dilatih. Juga didapati kedua-dua kumpulan menunjukkan peningkatan signifikan dalam prestasi akademik, dengan p = .000 bagi kumpulan-dilatih dan p = .00 bagi kumpulan-tak-dilatih. Namun, berkaitan dengan peningkatan akademik, kumpulan-dilatih mencapai 25% peningkatan berbanding dengan 7% peningkatan bagi kumpulan-tak-dilatih. Berdasarkan hasil penilaian-kendiri didapati kumpulan-dilatih mencapai kesan berikut setelah melalui latihan berkaitan: rasa lebih rileks dan tenang, lebih konfiden, pengurangan kadar denyutan jantung, penambahbaikan teknik pernafasan, penambahbaikan kemahiran belajar, pembaikan pengurusan masa, peningkatan konsentrasi, dan peningkatan kesejahteraan secara keseluruhan. Dengan itu boleh dirumuskan bahawa"biofeedback" intervensi programa adalah berkesan untuk mengurangkan kegelisahan pengajian dikalangan pelajar dan meningkatkan prestasi akademik. Di samping itu, kajian ini menyokong "Catastrophe model" untuk memeriksa kesan daripada "biofeedback" intervensi program dalam mengurangkan kegelisahan untuk peningkatan prestasi akademik.

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LIST OF SYMBOLS

Symbols:	**Title**
>	More than
<	Less than
F	Coefficient for repeated measure ANOVA
t	Coefficient for One sample t-test and Paired sample t-test
Z	Coefficient for Wilcoxon Signed-rank
r	Coefficient correlation
p	Significant value
$ή^2$	Effect size
n	Sample size

LIST OF ABBREVIATION

Abbreviation No:	Title
GPA	Grade Point Average
STAI	State Trait Anxiety Inventory
SAS	Study Anxiety Scale
SAI	Study Anxiety Intervention
BPM	Beat per minute
bpm	breath per minute
SD	Standard Deviation
M	Mean
FKKSA	Fakulti Kejuruteraan Kimia dan Sumber Asli
FKASA	Fakulti Kejuruteraan Awam dan Sumber Alam
FKM	Fakulti Kejuruteraan Mekanikal
FEE	Fakulti Elektrikal dan Elektronik
FKP	Fakulti Kejuruteraan Pembuatan

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Anxiety is one of the prevalent problems affecting students, and in the past 15 years, Anxiety Disorders Association of America (ADAA) has found that 75 percent of university students experienced anxiety (Margarita, 2008). When students pursue their studies at the university after leaving school, students go through a transition phase as they will face different environments and more challenging curriculum than those at school, and consequently, they are likely to experience anxiety disorders. Findings from various researchers have found significant existence of anxiety among university students (Carroll and Garavalia, 2004; Chada et al., 2007; Nonis and Hudson, 2006; and Sansgiry et al., 2006).

Recently, a study conducted among Malaysian university students found that 55 percent of the 584 respondents experienced anxiety (Gan et al., 2011). Mastor et al. (2007) found that Malay ethnic students tend to be more anxious, more depressed, shy, and impulsive as compared to Chinese students. Previous studies have reported of specific type for the existence of anxiety disorders among Malaysian students. As reported by Marwan (2007), Abd Aziz (2007), and Che Ya (2007), foreign language anxiety is one common type of anxiety disorder among university students. Other studies also showed the existence of mathematics anxiety among elementary school (Puteh, 2002), Form Four students (Idris, 2006), and matriculation students (Zakaria and Norazah, 2007). Moreover, a research conducted at University Malaya also found that medical student experienced social anxiety and library anxiety (Salina et al., 2008; and Ansari, 2009), while engineering students were to suffer anxiety related to foreign language (Hizwari, 2008; Abdullah and Nurul, 2010).

It has been shown that high levels of anxiety among students can interfere with their daily studies (Melinda, 2008), and could lead to the students' lack of desire to learn and failing to fulfil the learning tasks (Elsie, 2000). Moreover, anxiety disorders can manifest in the behaviour of the students in the classroom as they tend to be more passive in their study (Robert, 2007). In an extensive review of 126 studies, Seipp (1981) concluded that there is a relationship between anxiety and academic performance. The relationship of anxiety and academic performance has been supported by the findings from studies conducted by Heather and April (2008), Soler (2005), and McCraty (2007), who reported that anxiety can influence students' academic success. It has been found that those who had high anxiety level achieved low academic performance (McCraty et al., 2000; Anastasia, 1994; Luigi et al., 2007; and Sena et al., 2007). High levels of anxiety also lead to decreased of working memory and disturbance in the students' activities (Cassady and Johnson, 2002; and Aronen et al., 2005). Furthermore, according to the theory of relationship between anxiety and performance, anxiety is seen as physiological arousal and cognitive anxiety which can affect performance (Hardy and Fazey, 1987). The theory attempts to explain the interaction of cognitive anxiety and physiological arousal and its effect on performance as when both cognitive anxiety and physiological arousal levels are high then the performance will decreases.

A study by Felder et al. (1995) found that anxiety has become a significant factor affecting the academic performance of engineering students as many of them experience some academic challenges while undergoing engineering programs. Furthermore, Felder et al. (1995) also found that high anxiety levels can be obtained from the many engineering courses enrolled and the large amount of work required for each course. Anxiety occurs with a negative impression among engineering students due to the technical courses, too much emphasis on individual work, and level of academic competition (Kolmos and Holgaard, 2008). Consequently, some engineering students are frustrated and dissatisfied with their academic performance, especially when they are confronted with assignments, social integration, attitude, and motivation problems (Amenkhienan and Kogan, 2004).

According to a study carried out by Anxiety Disorders Association of America (ADAA), the findings showed that mental health services is required to handle anxiety disorders for college and university students (Bolden, 2008; Margarita, 2008). Nevertheless, a survey among 2,785 students found that more than half of students who had significant symptoms of anxiety or depression did not receive treatment in handling the problem (Bio-Medical, 2007). These evidences show that anxiety is prevalent and persistent among students and most of them did not receive treatment even over two years period of study (Zivin et al., 2009; and Cranford et al., 2009). Yale Medical Group (2007) and Bio-Medicine (2007) also reported that there were not enough programs offered by the university to treat anxiety disorders for students. Generally, universities have academic probation program which is aimed at improving students' academic performance through workshops, tutorials, counselling, and academic advice but not enough program on how to reduce with anxiety is offered. High anxiety students require special attention and need to be provided with preventive solutions to reduce their anxiety (Ratanasiripong et al., 2010). Related opinion by Robert (2007), it is necessary to provide training for students to address their anxiety.

Hence, based on the aforementioned discussion, this study also proposes to deal with the influence of anxiety on academic performance. There is a need to employ appropriate intervention program on the students to reduce the level of anxiety that could improve their academic performance. There are few training proposed as a useful technique for reducing anxiety including cognitive behavioural therapy (Borkovec et al., 2004; Wood, 2009), exercise training (Herring, 2010), problem solving technique and anxiety management training (Salami, 2004), biofeedback technique (Kathleen, 1982; Wenck, 1996; Andarsik, 2003; and Morarend et al., 2011), and meditation (Krisanaprakornkit et al., 2006). However, biofeedback is one of the most useful techniques in treating anxiety disorders (Brauer, 1999; Lehrer and Woolfolk, 2007; Sutarto and Wahab, 2008). The technique has been there for the last twenty years toward reducing the anxiety (Stephen, 2001). Currently, biofeedback is used to improve human performance by combining breathing therapies to reduce anxiety and relaxation to control patterns of physiological response (McCraty, 2005; and Thurber, 2006). According to researchers in the field of biofeedback, anxiety can be effectively reduced by practicing slow breathing with diaphragm to control the heart rate (Lehrer and

Woolfolk, 2007; and Pierini, 2010). There are several trainings using biofeedback techniques to reduce anxiety in performance enhancement programs, which include heart rhythm coherence feedback (McCraty and Tomasino, 2004), heart rate variability biofeedback (Sutarto and Wahab, 2008), and psychophysiological coherence (McCraty, 2005). This biofeedback technique is also found to be effective in reducing music performance anxiety among university students (Thurber, 2006), and improving sport's performance (Lagos et al., 2008; and Tanis, 2008). Thus, this study proposes biofeedback intervention program to reduce anxiety in order to improve the academic performance among engineering students.

Biofeedback training can help students learn to enhance emotional intelligence as well improve their academic achievement (Stephen, 2001). McCraty (2007) reported that students who learn and practice the techniques of biofeedback showed significant improvement in emotional state, classroom behaviour, learning and academic performance. In a similar research, Institute of HeartMath investigated the relationship between anxiety and academic performance, and it is found that students who encounter high anxiety level had attained low performance in their studies (Institute of HeartMath, 2004). Consequently, the Institute of HeartMath introduced an intervention technique called "TestEdge" which was used in handling test anxiety to enhance mathematics and language scores for high school students (Institute of HeartMath, 2004). The TestEdge was designed for interactive learning program, the component are include freeze-frame to increase focus and problem solving ability, test smart strategies for addressing test questions, and breathing exercise which suitable for primary and secondary school students(Institute of HeartMath, 2004). The result show increasing test scores in mathematics and language by improving test taking skills among high school students.

In Malaysia studies, Michael et al. (2005) found that beta electroencephalogram (EEG) biofeedback training can help cardiovascular patients reduce their feeling of anxiety. Furthermore, heart rate variability biofeedback training was found to improve cognitive performance among female operators in manufacturing plants (Sutarto and Abdul Wahab, 2008). However, no studies have been conducted utilizing biofeedback intervention program to reduce anxiety among engineering students as well as to assist them improve their academic performance. Therefore, this study proposes a biofeedback

intervention program to help students learn to reduce anxiety in improving academic performance. This study also attempts to identify study anxiety sources among engineering students.

1.1 PROBLEM STATEMENT

Study anxiety is a specific condition experienced by students while undergoing to their study. An American study accounted the occurrence of anxiety in 75 percent of university students (Margarita, 2008). In Malaysia it is found that 55 percent of university students experience anxiety during study (Gan et al., 2011). A new courses and changes in social situations, that was may be potential for the occurrence of anxiety disorders among students. Particularly for students in engineering courses, the emphasis on individual work and grading competitive are potentially in increased levels of anxiety (Felder et al., 1995). Researchers have identified certain types of anxiety among students including social anxiety (Purdon et al., 2001; and Cooley, 2007), language anxiety (Abd Aziz, 2007; and Horwitz, 2007), mathematics anxiety (Erden and Akgul, 2010; and Idris, 2006), family anxiety (Uwaifo, 2008), library anxiety (Carlilie, 2007; and Anzari, 2009), presentation anxiety (Murugesan, 2005; and Elliot and Joyce, 2004), and exam anxiety (Sansgiry et al., 2006; and Pecoraro, 2006). The specific type of anxiety that has been found by prior studies, it will be collected to identify the source of study anxiety among engineering students at University Malaysia Pahang.

High levels of anxiety that is not properly handled will reduce students' ability in working memory, concentration, and reasoning during their study. It has been found that anxiety can manifest in the students' behaviour, which students with anxiety disorders might not attend classes and chose to be passive in the classroom (Robert, 2007). Moreover, researchers have found that anxiety has negative effect on academic performance (Anastasia, 1994; McCraty et al., 2000). In particular, student who has high level anxiety achieve low academic performance (Luigi et al., 2007; McCraty, 2007; and Sena et al., 2007). According to the theory of the relationship between anxiety and performance (Fazey and Hardy, 1988), the theory predicted that the relationship between changes in anxiety on performance can be seen when physiological arousal is low, cognitive anxiety has a positive relationship with

performance and when cognitive anxiety is high, it will increase the level of physiological arousal to drop performance. Physiological arousal is associated with anxiety concerns in physical ability that was decrease human performance (Fazey and Hardy, 1988). Cognitive anxiety is considered to be a negative concerns related to mental ability that was decrease human performance (Fazey and Hardy, 1988). Moreover, the theory predicts that high levels of cognitive anxiety and physiological arousal will decrease performance.

Anxiety is one of the various types of emotional and behavioural disorders which need to be taken care of effectively (Rachel and Chidsey, 2005). Previous studies have found that there are students who experienced anxiety but did not receive treatment in the more than two years of study (Zivin et al., 2009; and Cranford et al., 2009). However, high anxiety students require for special attention and they need to be provided with preventive solutions, such as special guidance to reduce anxiety (Ratanasiripong et al., 2010). Currently, no previous study on identifying anxiety sources as well as intervention program to reduce study anxiety for the improvement of academic performance among engineering students in Malaysia has been documented. The previous studies only focus on schools students, medical students, and arts students. Therefore a study among engineering students is required.

Furthermore, this study used of biofeedback intervention program to reduce study anxiety in order to improve students' academic performance is proposed. Researchers have explored the use of feedback training in the past and found that it has positive effects in improving human performance by reducing anxiety. However, presently there is insufficient study to assess the effect of biofeedback intervention program in reducing anxiety for academic performance enhancement among engineering students.

Although the previous studies have identifies specific type of anxiety among students, such as exam anxiety, language anxiety and library anxiety. However, no studies have been conducted to identify the common source of study anxiety among engineering students. The identification of the study anxiety sources would assist in the construction of the intervention training needed for reducing study anxiety. The

biofeedback intervention program teaches student the techniques that they can use in order to reduce anxiety and enhance academic performance. The physiological techniques can help students reduce their anxiety through breathing retraining, relaxation and visual relaxation. In addition, the cognitive skills can decrease anxiety by improving their mental ability including study anxiety coping skill, resource management skill, learning strategies skill, time management skill, and study skill. Accordingly, this study aimed to assess whether the biofeedback intervention program could reduce study anxiety in the improvement of academic performance among engineering students at Universiti Malaysia Pahang.

1.2 RESEARCH OBJECTIVE

The purpose of this study is to accomplish the following objectives:

a. To identify significant sources of study anxiety among university students.
b. To examine the relationship between anxiety and academic performance.
c. To develop intervention module for reducing study anxiety in order to improve academic performance.
d. To examine the effect of biofeedback intervention program for the improvement of academic performance among engineering students at UMP.

1.3 RESEARCH QUESTION

The purpose of the research question is to examine the research objectives regarding the effect of intervention in reducing study anxiety to improve academic performance. The following research questions are formulated.

a. What are the potential sources for learning to create anxiety among the students?
b. Is there a relationship between study anxiety and academic performance among university students?
c. What is the suitable intervention program to reduce study anxiety in order to improve the academic performance?
d. What is the effect of biofeedback intervention program in improving academic performance?

1.4 HYPOTHESIS

The study used alternate hypothesis to examine the effect of intervention in reducing study anxiety levels to improve students' academic performance. Students in the training group learned ten sessions and no session for the non training group. The hypotheses are predicted as follows:

a. Hypothesis 1 is to answer the research question one with sample t-test question to find out the significant level of study anxiety sources.
   - Ha_1 = The seven sources will show significant created anxiety among university students.

b. Hypothesis 2 is to answer the research question two with Pearson correlation to find out significant correlation of anxiety and academic performance.
   - Ha_2 = There will be significant correlation between study anxiety and academic performance among university students.

c. Hypothesis 3 is to answer the research question three with repeated measure of ANOVA to examine the effect of intervention in time changes of physiological arousal.
   - Ha_3 = Students in the training group will show significant changes of physiological arousal.

d. Hypothesis 4 is to answer research question three with Paired t-test to examine the effect of intervention in pre post training of physiological arousal between groups.
   - Ha_4 = Students who learned the intervention for ten sessions will show significant reduced a physiological arousal from pre to post than students who have not learned.

e. Hypothesis 5 is to answer research question three with Paired t-test and Wilcoxon to evaluate the effect of intervention in reducing cognitive anxiety in pre post training between groups.
   - Ha_5 = Students who received the intervention for ten sessions will show significant decreased of cognitive anxiety from pre to post than students who have not received

f. Hypothesis 6 is to answer the research question four with Paired t-test to examine the effect of intervention in the academic performance.

- Ha_6 = Students who learned the intervention for ten sessions will show a higher GPA increase than students who have not learned

g. Hypothesis 7 is to answer the research question four with multiple linear regression to assess the Catastrophe model in the effect of biofeedback intervention program in order to determine a significant correlation between changes in anxiety about academic performance.

- Ha_7 = There will be significant correlation between changes in anxiety to academic performance.

1.5 RESEARCH SCOPE

The scope of this study is to identify the possible sources of study anxiety. Previous research has found seven types of anxiety as possible sources of study anxiety among university students. The sources of study anxiety include anxiety during examinations, anxiety in learning a foreign language, mathematics anxiety, the anxiety associated with social problems, anxiety in the presentation, anxiety related to the problems in the family, and anxiety in the use of the library. The existence of these sources among university students is possible and need to be investigated.

University Malaysia Pahang (UMP) has been chosen for this study to help the students handle anxiety during their study, hence improving their academic performance. UMP is an engineering focused university. The retention of engineering students is a difficult problem, since requirements for admission are often higher than average. The engineering curriculum is very demanding and students may drop out due to poor academic performance. Obviously there are many reasons that can create anxiety and consequently result in poor academic performance. 770 students participated in the survey, 205 students participated in the test of anxiety, and 70 students participated in the training. Although limited to one university, this study illuminates many factors that can help engineering students improve their academic performance.

The intervention can be looked into from two aspects, namely, the effectiveness of the physiological treatment and the cognitive improvement. For the physiological

techniques, the materials are adopted from existing biofeedback protocol. The techniques involve slow breathing using the diaphragm, relaxation, and visual relaxation. On the other hand, cognitive skills aimed to teach students to independently solve problem related with study anxiety. The skills include study anxiety sources coping skill, management resource skill, learning strategies skill, time management skill, and study skill. The intervention delivers in biofeedback training to teach students regarding those skills. Biofeedback training had positive effect to peak human performance by reducing anxiety.

A total 10 sessions of biofeedback training with pre post design is suitable to learn to reduce anxiety and improve academic performance. Respondents in the research were divided a training group which received the full training and a non-training group which received no intervention. Respondents received pre-test to measure anxiety level, and then the training group are trained to reduce anxiety. After the 10th session, the respondents received post-test to examine the effect of intervention. The result aimed to examine the intervention effect by comparing the anxiety levels of the two groups before and after the training is given.

The effect of biofeedback intervention program to reduce study anxiety and to improve academic performance was examined with engineering students. The intervention can be used for students with the similar characteristics with sample respondents to improve their performance. The independent variable is study anxiety measured by physiological arousal and cognitive anxiety level, the dependent variable is academic performance measured by grade point average (GPA).

1.6 SIGNIFICANCE OF THE RESEARCH

This study was significant in three aspects. Firstly, the research addressed sources of study anxiety among university students. Second, it developed intervention technique to reduce anxiety and improve academic performance. Third, it informed policy makers at the university level, students, curriculum specialists, education practitioners, and funding services of the issues affecting low academic performance.

A lot of factors influence students' low academic performance. The study addresses study anxiety sources among students. Identification of the sources is necessary to understand the potential sources of anxiety during study in the university. The results help to determine how the potential sources must be handled during an academic sessions.

To help students' improve their academic performance, universities normally offer counselling service, tutorials sessions, workshops, and other related activities. However, it is not sufficient for students. Previous studies observed that emotional factors probably contribute to the decline in students' achievement as one's emotional level is important to his success in whatever he is doing. Students who are facing problems academically also have increasing sense of anxiety. The sources of anxieties include various tasks, assignments, subject difficulties, examinations, and other activities that will disturb their performance. This study proposed a program to reduce anxiety for improving academic performance. The program is called biofeedback training by delivering techniques of intervention, and is very useful for students to master in reducing anxiety and improving academic performance.

This training is expected to be implemented as an academic probation or academic course curriculum to support students' success and it has important implications for the university, students, curriculum specialists, education practitioners, and services that are related with these issues.

1.7 DEFINITION OF TERMS

The concepts and terminologies used in this study are study anxiety, cognitive anxiety, physiological arousal, academic performance, engineering undergraduate students, and biofeedback training. These terms are briefly explained as follows:

a. Study anxiety is a specific situation that refers to anxiety conditions that are experienced during study process and could disturb students' academic performance. Study anxiety has two dimensions, namely, cognitive anxiety and physiological arousal.

b. Physiological arousal is associated with anxiety concerns in physical ability that was affected human performance (Fazey and Hardy, 1988). The physiological arousal symptoms such rapidly of heart beat, skin temperature, muscle tension, and breathless.

c. Cognitive anxiety is considered to be a negative concerns related to mental ability that was affected human performance (Fazey and Hardy, 1988). The cognitive anxiety symptoms such panic, nervous, lack of confident, fail in examination, and experiencing learning difficulties.

d. Academic performance is the observable and measurable behaviour of students at any point in time during their study, and grade point average (GPA) is obtained from final examination scores (Yusuf, 2002). The study is targeted at students with low academic performance with GPA < 2.50. The category of GPA level was found from academic guidance books of UMP, UKM, UPM, UPSI, UTM, UTHM, and UMT (Universities document, 2009).

e. Engineering undergraduate students are those who study engineering subjects through bachelor degree program.

f. Biofeedback training is the educational process to learn specialized mind/body skill to recognize how their bodies are functioning and to control patterns of physiological functioning, in the term of reduced study anxiety (Stephen, 2001, and Arguelles et al., 2003). The biofeedback is a set of intervention techniques, skills, and equipment.

1.8 OPERATIONAL DEFINITION

Operational definition is to identify the variables. The operation has an immediate impact on the study, especially of the findings.

a. Study anxiety is identified as possible sources related to anxiety during study among university students by using survey questionnaire.

b. The relationship of study anxiety and academic performance, study anxiety level is determined using combine scores of State and Trait.

c. The level of cognitive anxiety is calculated using State (STAI Form Y-1), Trait (STAI Form Y-2), and Study Anxiety Scale (SAS).

d. Physiological arousal is determined through Nijmegen questionnaire, beat per minute (heart rate), and breath per minute (respiration rate) using biofeedback device.
e. Academic performance is calculated through students' grade point average (GPA); GPA is an average of the academic results by credit hour and quality point equivalent of the grade for all courses divided by the total credit hours registered in the semester.
f. Biofeedback training is learning the intervention techniques and skills to reduce study anxiety in improving academic performance.

1.9 SUMMARY

This chapter describes the foundation of the study which includes research background, research problem, research objective, research question, hypothesis, research scope, significant of research, definition of term, and operational definition. The next chapter discuss the latest and theoretical background of the study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents the relevant literatures on anxiety, biofeedback, and academic performance to provide framework for this study. These are organized into seven sections: the first section introduces this chapter, the second section presents the theoretical framework, the third section obtained source of study anxiety among students, the fourth section explores the relationship of anxiety and academic performance, the fifth section looks at the suitable intervention for reducing anxiety, the six focuses on the biofeedback training in reducing anxiety and improving performance, and the last section are summary this chapter. These sections are explained below.

2.2 THEORETICAL FRAMEWORK

The theoretical framework in this study is adopted from Catastrophe theory, in which the theory attempts to explain how the interaction of cognitive anxiety and physiological arousal affect on performance (Hardy and Fazey, 1987). Figure 2.1 displays theoretical model of anxiety on performance.

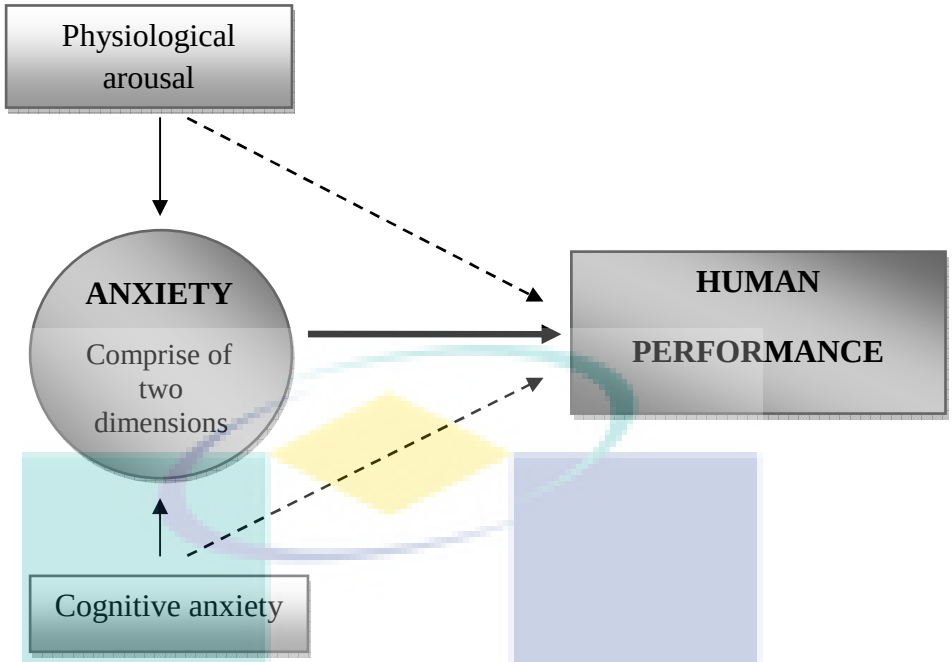


Figure 2.1: Model of Theory

The Catastrophe Model (Fazey and Hardy, 1988), is a three dimensional model that predict the interactive effects of cognitive anxiety and physiological arousal on performance. The model predicted that:

a. Cognitive anxiety has a positive relationship with performance when physiological arousal is low.
b. Cognitive anxiety will have a negative relationship with performance when physiological arousal is high.
c. When cognitive anxiety is high, on increased level of physiological arousal leads to catastrophic drop in performance.

While cognitive anxiety has negative effects on human performance, physical anxiety is concerned with perception of physiological to psychological response such as sweaty palms, racing heartbeats, or butterflies in the stomach. Robb (2005) proposed that while cognitive anxiety would have negative correlation with performance whereas physiological anxiety has curvilinear relationship with performance. Hence, cognitive anxiety is the component that most strongly affects performance (Ingugiro, 1999; and Robb, 2005).

Through meta-analysis Robb (2005) found a weak relationship between cognitive anxiety, physical anxiety, self confidence and performance. The multidimensional theory predicts separate relationship between cognitive anxiety, somatic anxiety, and performance (Ingugiro, 1999; and Robb, 2005). Whereas the catastrophe model proposed that cognitive anxiety and physiological arousal can affect performance. Cognitive anxiety is deals with negative concern and self-doubt in relation to performance (Fazey and Hardy, 1988). Physiological arousal associated with anxiety such heart beat has been shown to fluctuate continuously during performance (Fazey and Hardy, 1988). Somatic anxiety can be defined as one's perception of affective physiological elements of the anxiety experience (Robb, 2005). Similar implication can be given to physiological arousal and somatic anxiety since both explained physical affect on performance because of anxiety such heart beat and sweaty palm.

However, the Catastrophe theory basically supports multidimensional theory. Catastrophe theory is the most prominent theory accepted, advanced and evaluated to define the relationship of anxiety on performance (Ingugiro, 1999). Ingugiro (1999) has used the Catastrophe model for research in higher education and in wide range of applications. The application of Catastrophe theory is to view and predict the relationship as well the intervention that has been developed and used in an attempt to cope with study anxiety to improve academic performance. The model used to predict interactive effects for cognitive anxiety and physiological arousal upon performance in a three dimensional model (Fazey and Hardy, 1988). The Catastrophe Model is shown in Figure 2.2.

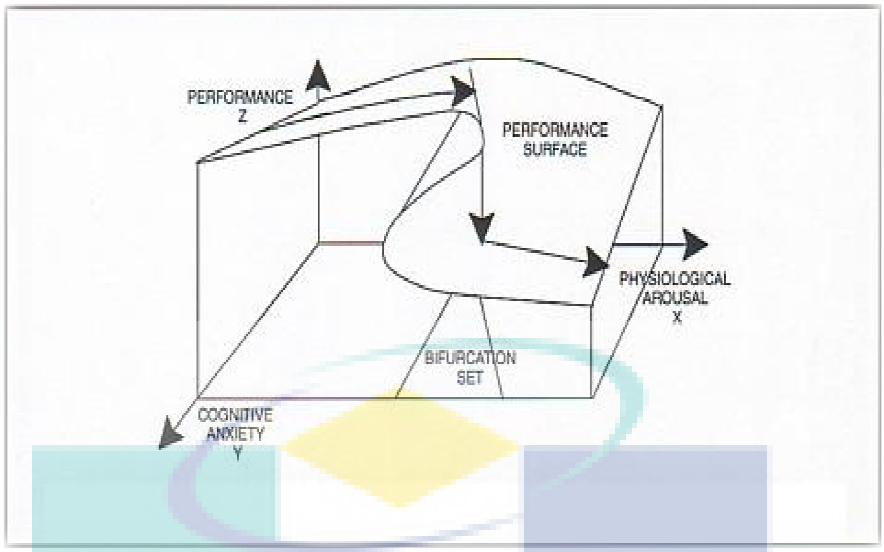


Figure 2.2: The Catastrophe Model of Anxiety upon Performance,

Source: Hardy and Fazey (1987)

The Catastrophe Model contains perpendicular *x*, *y*, and *z* axes. The x-axis denotes physiological arousal and it runs horizontally along the lower back wall of the model. Cognitive anxiety is denoted by the y-axis which runs perpendicular to physiological arousal and runs along the lower left side of the model. Performance is denoted as the z-axis, while the surface represents high performance.

Previous studies found that anxiety affects performance in many fields including sport performance (Abenza et al., 2009), music performance (Thurber, 2006), as well student performance (McCraty, 2005). McCraty in his article An Overview of Research (2000) stated that cognitive and physical performance help understand how emotions affect the nervous system. Therefore, this study adopts the Catastrophe theory model of anxiety upon performance by Fazey and Hardy (1988), where physiological arousal and cognitive anxiety are used to predict study anxiety, the Grade Point Average (GPA) is used to predict students' academic performance (Carroll and Garavalia, 2004; Sansgiry et al., 2006; and Klomegah, 2007).

2.3 SOURCES OF STUDY ANXIETY AMONG STUDENTS

Study anxiety is a specific-situation that refers to anxiety conditions that are experienced during the study process and could be an obstacle to academic performance. Definition of anxiety and the potential sources of study anxiety among engineering students are explained as follows.

2.3.1 Definition of Anxiety

Anxiety is a kind of the psychophysiological difficulty (Callahan, 2001; and Imperial College Health Centre, 2005). These symptoms can be psychological, physical or environmental. There are various forms of anxiety and they include excessive worrying, a sense of fear, restlessness, overly emotional responses, and negative thinking. A person may be anxious but appears calm; however, the brain cannot stop thinking and cannot shut down. The situation can get so bad as to interrupt the quality of life. Experts have many definitions to describe anxiety. Brauer (1999) mentioned that all of the anxiety disorders are defined by the dual characteristics of excessive emotional fear and physiologic hyper arousals. Harris and Coy (2003) defined anxiety as a basic human emotion consisting of apprehension and uncertainty that typically appears when an individual perceives an occurrence as being a threat to the ego or self-esteem. In the conceptualization, individuals with high levels of anxiety generally hold heightened levels of trait anxiety, but in evaluative situations, the state anxiety also elevates.

According to Spielberger (1995) anxiety is an emotional state consisting of feeling, tensed, apprehension, and nervousness. These can be differentiated into different of time situation such state anxiety and trait anxiety. State anxiety is a transitory emotional condition reflective of one's interpretation of a particular stressful situation at a particular period of time or feeling at a particular moment in time. Trait anxiety is the enduring personality characteristic that refers to relatively stable individual differences that characterizes people's anxiety or general feeling of anxiety (Spielberger, 1983). Spielberger's theory of anxiety has led to understanding the concept of anxiety. It has been found that a certain level of anxiety can become a facilitative tool for an individual to perform effectively. The combination of feeling and

anxiety can interfere with performance by blocking utilization, attention resources, or more cognitive interference from the worries and fears induced by anxiety. Anxiety is an occurrence that human beings normally encounter within their daily experiences. It is considered to be one of the most widespread and persistent human emotions, with affected physiological arousal and cognitive functions. In addition to being subjectively unpleasant, anxiety has overheads in contend for bodily (physiology) and cognitive resources (Kalisch et al., 2005).

Anxiety attacks are very real to the person having one and can paralyze someone from doing even the simplest of daily tasks. All of anxiety disorders are defined by the dual characteristic of physiological hyper arousal and excessive emotional fear. Anxiety sensitivity is the fear of anxiety related sensation such as increased heart rate and breathlessness (Stewart et al., 1999).

2.3.2 The Potential Sources of Study Anxiety among Engineering Students

Study anxiety is a specific situation refers to anxiety conditions and could disturb students' academic performance. Previous studies have found some specific types of anxiety related to university student who is likely to be a source of anxiety among engineering students including social anxiety (Purdon et al., 2001; and Cooley, 2007), language anxiety (Abd Aziz, 2007; and Horwitz, 2007), mathematics anxiety (Erden and Akgul, 2010; and Idris, 2006), family anxiety (Uwaifo, 2008), library anxiety (Carlilie, 2007; and Anzari, 2009), presentation anxiety (Murugesan, 2005; and Elliot and Joyce, 2004), and exam anxiety (Sansgiry et al., 2006; and Pecoraro, 2006). Some research indicates that there is a complex inter-relationship between the various sources, such as language anxiety - presentation anxiety (Murugesan, 2006), exam anxiety - language anxiety (McCraty et al., 2000), and family anxiety - social anxiety (Elizabeth, 2003). Identification of study anxiety sources is important so as to understand the potential sources, to design the intervention program, and to deliver instructions. Explanation of study anxiety source among students is presented below:

a. **Exam Anxiety**

Exam anxiety is the utmost research concern in studies, handling and designing intervention to improve test taking skills. Students feel anxious when taking a test and as a result their brain may cease to function effectively (An overview of research, 2000). The previous study on test anxiety found that the apparent relationship between emotionality and test performance. Thus, emotionality impact on test performance is only under situations where the individual maintains a high level of cognitive test anxiety (Cassady and Johnson, 2002; and Spielberger, 1980). Exam anxiety basically is rooted in some type of fear such as fear of failure, lack of self confidence, fear of blanking out a test, poor time management or study habits, lack of organization, and concern over how test results will impact future plans (Institute of HeartMath, 2004). According to Sansgiry et al. (2006) that exam anxiety is a major predictor of academic performance and various studies have demonstrated that it has a detrimental effect. Almost everyone experience anxiety while taking examination, hence exam anxiety is a significant problem for many students. Too much anxiety can block thoughts; create negative frame of mind, and cause potentially poor examination performance. Sometime exam anxiety is likened to a lack confidence or low self esteem. Pecoraro (2006) reported that students who are not well prepared for examination may have higher levels of task-interfering worry during examination than those are better prepared.

According to Sansgiry et al. (2006) some students (22%) indicated experiencing nervousness during examinations, and more than two thirds of the respondents (69.3%) experienced some level of anxiety during examinations. Even though they thought they were well-prepared, the majority of students indicated that they do not have physical symptoms such as perspiration (75.8%), stomach upset (64.8%), and increased heart rate (58.0%) (Sansgiry et al., 2006). Heather and April (2008) believed that high anxiety level interferes with test performance, while low test anxiety helps to improve examination performance. Previous study found similar results that anxiety can interfere with students' performance in examination (Barbara, 2002; Harris and Coy, 2003; and McCraty et al., 2000). Reduced exam anxiety is associated with increased positive emotions and feeling that are related with reduction in negative feelings, emotional discord and difficulty in relationship (An overview of research, 2000).

b. **Language Anxiety**

Language anxiety is one of the anxiety sources during study, and hence has an effect on students' academic performance (Horwitz, 2007). According to Worde, half of students examined reported experiencing debilitating levels of language anxiety (Ying, 2008). The function of language is to communicate with other people, so language plays a crucial role as a communication medium. Investigation of language anxiety has been carried out among University students in Malaysia. Abd Aziz (2007) reported that students who experienced language anxiety showed high score in foreign language anxiety and test anxiety due to feeling worried about failing (Hizwari et al., 2008). MacIntyre observed that language anxiety is a form of situation-specific anxiety experienced in a particular foreign language context (Ying, 2008). Matsuda and Gobel (2003) claim that language anxiety is a unique type of anxiety specific to foreign language, and that there is a great deal of language anxiety in such aspects as speaking, listening, writing, and reading. Similarly, Horwitz (2007) conceptualized foreign language anxiety as a distinct complex of self perceptions, beliefs, feelings, and behaviour related to classroom language learning. With a different perception, Ying (2008) mentioned that language anxiety is caused by (a) personal and interpersonal, (b) learner beliefs about language learning, (c) teacher belief about language anxiety, (d) teacher-learner interactions, (e) classroom procedures, and (f) language testing.

Previous studies have shown that there is a correlation between language anxiety and students' performance. It was found that low anxiety students achieve better grades in foreign language than high anxiety students. Language anxiety has been shown to be a significant factor in the learning process (Bai et al., 2009). Students with high level of anxiety made different types of grammatical errors, have difficulties speaking or interacting in a foreign language than those with low level anxiety (Murugesan, 2006). Kondo and Ying-Ling (2004) suggested five strategies for coping with language anxiety, and they include preparation, relaxation, positive thinking, peer seeking, and resignation.

c. **Mathematics Anxiety**

Mathematics poses a potential source of study anxiety among students, many of whom are observed to have a fear or even a dislike toward mathematics. Anxiety response to mathematics is a significant concern in terms of the perception that high anxiety will relate to avoidance of mathematical tasks (Anderson, 2007; and Furner et al., 2003). A study among university students found that high mathematics anxiety is correlated with poor performance in mathematics courses (Erden and Akgul, 2010). A prior study reported that low mathematics achievement is significantly related to a high level anxiety, and high mathematics anxiety is hardly related to low mathematics achievement (Ma and Xu, 2003). Mathematics is one of the fundamental skills to enable in sustaining of the daily life, the difficulty of mathematics experienced by them possibly increases their anxiety (Erden and Akgu, 2010).

According to Puteh (2002), one of the most important reasons perceived by Malaysians for learning mathematics is its importance as a passport to pursue further education through acceptance to higher institutions and a promise to better paid jobs either in the government or the private sectors. In another study on mathematics anxiety, Idris (2006) stated that performance of Malaysian students in mathematics has been generally not good starting from elementary school to university level. The National Philosophy of Education and Malaysia's Vision 2020 propose to produce a new generation of Malaysians who are able to think critically, systematically, and to use their knowledge of mathematics to meet new challenges in this fast changing world (Idris, 2006). Based on the statements, mathematics is an important subject to ensure students' success at any levels. Nonetheless, recognizing the symptoms could be helpful in handling mathematics anxiety.

The symptoms of mathematics anxiety can be described as state of anxiety which occurs in response to situations involving mathematics which are perceived as threatening to self-esteem causing panic, tension, helplessness, fear, inability to cope, and physiological symptoms such as loss of concentration and breathing difficulty (Uusimaki and Kidman, 2004). The thought of mathematics is scary and causes a great deal of anxiety for a lot of students, especially when they begin learn the subject

(Institute of HeartMath, 2004). Ma and Xu (2003) cited the main characteristics of discomfort towards mathematics to include dislike of the subject, worry, and fear, with specific behavioural manifestation such as tension, frustration, distress, helpless, and mental disorganization. Generally, students' fear of mathematics is because it is one of the difficult subjects involving calculations.

Engineering students have affiliation with mathematics as it is essential for engineering field as mathematics is be accepted as a language for describing physical, chemical, and other formulation in term of mathematical enquiry (Sazhin, 1997). Another opinion describes that mathematics is relevant to the core undergraduate engineering curriculum (Willcox and Bounova, 2004). The subject requires high levels of concentration compared with other subject in the engineering field (Sazhin, 1997), possibly causing anxiety towards mathematics among engineering students. For some students having to put high levels of concentration means that mathematics is a difficult subject for them. Mathematics anxiety is manifested into five dimensions for engineering students namely; (a) feel mathematic is difficult subject, (b) always fail in mathematics, (c) always writing down in a mathematics class, (d) anxious if they do not understand, and (e) lose interest on mathematics. In trying to reduce mathematics anxiety, Puteh (2002) suggested using training in helping students to identify and modify mathematics anxiety.

d. **Social Anxiety**

Social anxiety causes individuals to feel fear of social situations. People tend to assume that if they feel anxious in a social situation, it is because they are not performing well (Pardon, 2001). Kimberley et al. (2007) conceptualized four approaches to understanding social anxiety. The first is the skill deficit model which describes social anxiety as the result of an individual lacking the skills to handle situations perceived to be threatening. The second is the cognitive–self model which states that social anxiety is not due to lack of skills, but a perception of personal inadequacy. The third is the classical conditioning model where social anxiety is conditioned when neutral stimulus associated with negative social experiences. Lastly,

the personality trait model which describes that social anxiousness is a trait rather than a reaction.

Previous studies have found symptoms of social anxiety as a sign of weakness, incompetence, mental instability, stupidity, and leading to humiliation or embarrassment which is a cardinal feature of social anxiety and accounts for much of the negative self-evaluation in social situations reported by social phobic individuals (Purdon et al., 2001). Another opinion cited by Alden in Purdon et al. (2001) is that individuals with social phobia also have a tendency to exhibit social anxiety symptoms. Studies of the negatively perceived symptoms of social anxiety within the general population might be helpful in treating the anxiety. Therefore, those who are concerned with exhibiting anxiety symptoms will significantly reduce social situations.

Social anxiety can also be seen in students with special needs as they are more likely to face this anxiety due to the low self-confidence they feel about being a rarity (Cowden, 2010). Symptoms of social anxiety often vary among students (Cooley, 2007). University students describe situations that cause them to feel shy, and people who feel socially anxious are often quiet, inhibited, and withdrawn (Mark and Robin, 1997). The effect of social life is an important issue in study anxiety, as seen in difficult relationship with roommate, problem with peers, and feeling uncomfortable in hostel (Naomi, 2007). Social anxiety will negatively influence an individuals' cognitive and affective behaviour (Kimberley et al., 2007). Being calm and relaxation techniques can help student manage anxiety. The techniques used will help student overcome in part social anxiety in a given class situation (Cooley, 2007).

e. **Family Anxiety**

The family has been recognized as having a lot of influence on the academic performance of students (Uwaifo, 2008). Family factors have contributed to the development of anxiety disorders among students such that children of parents with anxiety disorders have an elevated rate of anxiety disorders (Susan and Margareth, 2005). Individuals who never leave home tend to exhibit separation anxiety disorder when they are suddenly faced with the prospect of spending time away from home

(Elizabeth, 2003). Also, cases like divorced parents, family problems, family pressure, childhood experiences, and low appreciation of students' achievement also affect their academic performance (Susan and Margareth, 2005). The anxiety experienced from within the family component can cause a family member to experience anxiety; such experience are family dissatisfaction of a child's academic performance, financial problem, and also family size have significant consequences in students' life (Blake, 1989). The home has a great influence on the students' psychological and emotional well-being (Uwaifo, 2008). As a result of these factors that create family anxiety, students do not have sufficient exposure to the kind of education and experience so that they would more likely promote a positive feeling towards family problems. Hence, the family background affects students' reaction to anxiety.

f. **Presentation Anxiety**

Presentation anxiety is the fear experienced by students when giving presentation in class, and research has shown that the anxiety has significant negative effects on an individual's communication (Murugesan, 2006). Anxiety associated with giving presentation is an issue faced by university students as it occurs with reasonable frequency (Elliot and Joyce, 2004 and Stephanie, 2001). Performing in front of a group of other students, colleagues and lecturers is a difficult part of the students' experience and speaking in public can unsettle or even frighten some students (Anna and Marion, 2008). Presentation is considered to be of paramount importance to students, but Horwitz cited that feeling anxious among students can disrupt studying and in some cases skip classes entirely (Murugesan, 2006). According of Brenda and Tillson (2007) (2007) the fear of delivering a speech or presentation ranks as the number one fear among most people, including students. A survey of 550 students enrolled in first-year psychology and business units at an Australian university. Result found that approximately 70% of students identified a moderate level of anxiety associated with presentations (Elliot and Joyce, 2004). The high level of presentation anxiety has an impact on students' performance. A survey reported that class presentations are required of students' as part of their academic course evaluation (NUI Galway, 2008). Murugesan (2006) suggested presentation anxiety can be avoided by making adequate preparation and practice.

g. **Library Anxiety**

The last of the study anxiety sources is library anxiety. Every student is required to use the library at some point of his study. The term library anxiety was first used by Mellon in 1986 to describe the sense of fear and anxiety using the library among students (Carlile, 2007; and Cleveland, 2001). Cleveland (2001) defined library anxiety simply as negative feelings toward using the academic library. A previous study reported that 75% to 85% of undergraduate students experience uncomfortable cause of library anxiety (Qun and Anthony, 2002). Library anxiety is also defined as a negative experience characterised by excessive worry, self defeating thoughts, fear, tension and physiological arousal that arises during the typical library task cycle (Ansari, 2009). The theory of library anxiety proposed that when students are confronted with the need to gather information in the library, many become so anxious that students are unable to approach the problem logically and effectively (Carlile, 2007). Library anxiety is an obstacle to academic success among students (Ansari, 2009). In general, compared to low anxiety students, high anxiety students often have low self perception about their ability to use the library effectively. The phenomenon of library anxiety exists in Malaysian academic library environment (Ansari, 2009).

The seven sources have been presented as factors that increase anxiety during study among university students. These sources are actually related to one another. Presentation anxiety and language anxiety are manifested in students who are about to give class presentation in a foreign language. Family anxiety and social anxiety are related to childhood experiences that carry out into the social life. Mathematics anxiety and library anxiety are related to exam anxiety; students who lack the ability to perform in difficult subject and feeling anxious about using the library will be anxious about taking examinations. Nevertheless, many of the studies that have investigated this issue have not introduced a psychophysiological treatment for university students to reduce study anxiety so as to improve academic performance. Therefore, it is necessary to monitor and look into the associated problems in order to reduce study anxiety, and also strategize plans for improving academic performance. However, this study proposes to develop intervention techniques in response to the problem stated above.

2.4 RELATIONSHIP BETWEEN ANXIETY AND ACADEMIC PERFORMANCE

Engineering students have responsibility to maintain optimal academic performance. Felder et al. (1995) found that engineering course created high levels of anxiety regarding course load and schoolwork in general. The overall profile of the engineering student learning preference is similar to several other studies showing that engineering students are active, sensing, and visual (Kolmos and Holgaard, 2008). There is a need to be informed that for global competitiveness, engineering students requires an emphasis on the level of competence. The variety of interesting subjects involved in engineering course that was a reason for students can consider engineering as a career option. The curriculum load of engineering students demands the exploration of alternative support to increase their performance.

Student require of academic competence is ability to manage their study load (Sansgiry et al., 2006). However, the personal effort and involvement to suitable program will help to reduce anxiety and improving academic performance among engineering students. Amenkhienan and Kogan (2004) suggested for engineering students the following activities to improve academic performance include the application of efficient time management skills, the completion of assignments, the decision to participate in study groups, reading self-assigned material, attending tutorials, and seeking academically-related contact with peers. Hence, Grade point average (GPA) is a commonly used measurement of academic performance (Yusuf, 2002; and Sansgiry et al., 2006). The relationship of anxiety and academic performance can be explained as the following.

2.4.1 Anxiety Effect on Low Academic Performance

Several studies have been acknowledged the factors allied with academic performance. Researchers have found indication that psychophysiological difficulties affect academic performance (Stephen, 2001; Womble, 2003; and Gomes, 2002), poor academic performance as defined by diagnosis of learning disability or failure in academic subjects (Janet et al., 1987), and few researchers mentioned that anxiety

affected on low academic performance (McCraty et al., 2000; McCraty, 2007; Anastasia, 1994; Heather and April, 2007; and Sena et al., 2007). Klomegah (2007) revealed that academic performance and student ability in retention are associated with psychological factors, indicating that such factors should be considered when establishing programs to facilitate students.

Luigi et al. (2007) conducted prevalence of relationship between anxiety and academic performance among elementary, middle, and high school students. Sample of elementary (N = 131, age 8–10 years), middle (N = 267, age 11–13 years), and high school (N = 80, age 14–16 years). The respondents completed the Multidimensional Anxiety Scale for Children (MASC) which measures anxiety. Result found a statistically significant association between MASC total score in the anxiety level and poorer academic grades. Moreover, students with a MASC total score above 65 were more expected to produce unsatisfactory school grades (37%) than children with a non-anxious score below than 65 (18%).

In a similar study, El Anzi (2005) conducted a test to find out a significant relationship between academic achievement and anxiety. The anxiety level was measured using The Beck Anxiety Inventory and cumulative achievement was average to determine the academic achievement. The sample consisted of 400 male and female students in the basic education college in Kuwait. Result showed a negative correlation between academic achievement and anxiety. Dhyani and Agarwal (1988) selected 80 boys and 80 girls of high school students to measure the relationship of anxiety and academic performance. Anxiety was determined using the standardised test that has 40 items of anxiety. Students' high school mark sheet was used to assess academic performance. The finding of the study shows anxiety and academic performance have a definite relationship and negative correlation aimed that if anxiety increases the academic performance decreases. Another finding reported by Akbas and Kan (2007), who did study on 819 high school students. The instrument used anxiety scale construct for 10 items question. Result found that correlation between achievement scores and anxiety scores is at the level of .39. Indicated, that anxiety is a significant predictor of academic achievement.

Numerous of researches had administered of the State-Trait Anxiety Inventory to determine the relationship of anxiety to academic performance. Van Der Ploeg (1979) administrated the STAI among 180 second year medical students. Result found a significant negative relationship was obtained between the level of anxiety and level of academic success. STAI was used to predict anxiety level related with the academic stress among 249 university undergraduates (Misra and McKean, 2000). Frank et al. (2006) also investigates the relationship of stress, anxiety, and academic performance among 163 first and second year students completing STAI. Spearman correlation coefficients found high correlations of stress, anxiety, and academic performance (r = .705). Furthermore, result show second year students significantly anxious compared to the first year students with $p < .05$ (Frank et al., 2006). Similar finding cited by Spielberger et al. (1993), to evaluate the relationship of STAI scales and academic performance, the instrument was administered to approximately 1.200 freshmen entering Florida State University. The relationship show negative correlation of anxiety toward academic performance.

Recent findings in Malaysia, not many studies have cited the relationship of anxiety and academic performance for engineering students. Hassan et al. (2009) conducted a survey among 223 secondary school students, to find out correlation between the levels of anxiety to academic performance. The finding shows significant negative relationship with r = -.70, $p < .05$. The relationship of anxiety and academic performance were also analyzed based on the group of age for 13 years old student and 16 years old student. Result among 13 years old students' group found significantly negative relation in academic performance with r = -.65; $p < .05$. The equivalent value of correlation between the levels of anxiety with academic achievement also proved significant for the group of 16 years old students with r = - .65; $p < .05$.

A fair number of previous studies consistently reported a correlation between anxiety and academic performance (Sena et al., 2007; Soler, 2005; McCraty, 2007; and Anastasia, 1994). Researchers also have revealed that high levels of anxiety result in the decrease of working memory, cause distraction, and reasoning in students (Cassady and Johnson, 2002; and Aronen et al., 2005). Ibrahim (1996) has recognised that anxiety plays a significant role in students' learning and academic performance. In other words,

Hamzah (2007) has cited that students with higher level of anxiety tend to obtain lower marks in their end-of-semester examination. Researchers found many sources created by anxiety and has a influence toward academic performance can be interpreted such a social class, high activity, greater familiarity, gender, culture ecosystem, family related problem, hard to participate in class, to cope with subject matter, to ask questions, to join study group, to sit for examinations, and to give class presentation (Guerrero, 1990; Mayya et al., 2004; Murugesan, 2006; Anna and Marion, 2008; and Sansgiry et al., 2006). However, the correlation of anxiety and academic performance has been analyzed of 126 studies with a total sample size of 36.626 persons (Seipp, 1981). Generally, findings show that anxiety affected with poor performance. Figure 2.3 shows the relationship between study anxiety and academic performance.

2.4.2 Related Factors in Improving Academic Performance

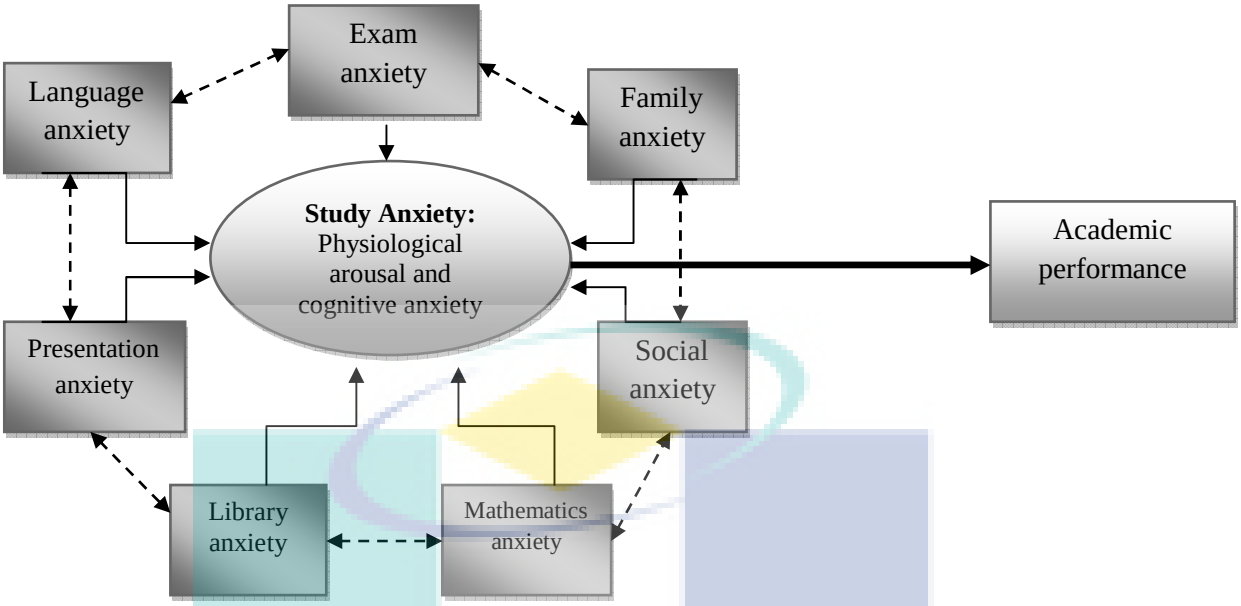
Identifying factors that influence students' academic performance is a primary goal of most educational researchers (Sansgiry et al., 2006). The factors influencing student's ability results are in their choice of activities, degree of effort, level of self-efficacy, motivational strategies, and level of persistence in times (Carroll and Garavalia, 2004). On the other hand, Abdullah (2002) mentioned criterion variables are good predictors of academic performance. The variables include positive inter-relationships with motivation to achieve, self-esteem, locus of control, and academic achievement of the students. Charlotte (2004) reported that study groups facilitate learning and improve course grades for the reason that they provide the opportunity to work collaboratively with other students on difficult material, obtain explanations from different perspectives, and learn by helping other students. For engineering students, researchers suggest three primary factors that influence academic performance namely individual effort and involvement, curriculum, peer interaction, and faculty contact (Amenkhienan and Kogan, 2004; and Chada, 2006). Nonetheless, successful academic performance is dependent upon effective studying and motivational strategies (Carroll and Garavalia, 2004).

Researchers have found that factors related to academic performance are influenced by academic preparedness, the number of semester, family and financial

assistance, and quality and quantity of the social support system; those who are academic unprepared are more likely to receive low grades or even fail in their course (Taniguchi and Kaufman, 2005). Another predictor of poor academic performance is sleep, as adequacy of sleep might be important to the improvement of students' memory and hence the students' academic success (Chada et al., 2007). Previous studies have observed a diversity of factors that have positive and negative influence on academic performance. The positive factors are motivational strategies, degree of effort, ability to manage time, and self esteem, while the negative factors are low social level, family and financial problems, sleep disorder, as well academic unpreparedness.

Academic performance is highlighted as a significant issue in the university. Researchers report that academic performance enhancement goes beyond the requirements such as reading self-assigned material, attending tutorials, and seeking academically-related contact with peers or faculty (Amenkheinan and Kogan, 2004). The most important effort is to eliminate the negative factors and optimize the positive factors to enhance academic performance.

With the aim at improving students' academic performance, Universiti Malaysia Pahang has both academic and non-academic facilities, such as library, classroom tutorials, sports' facilities, counselling services, computers, internet facilities, and academic advisor. The Library provides many sources of knowledge such as books, online journals, databases, computers, magazines, thesis and dissertations. Tutorial classes are available to all students and it assists students by way of individual instruction on the material presented in class. Tutorials are part of the learning process in UMP. Sports' facilities are help student to release their tension with physical exercises. Internet facilities are provided to assist students to find information in order to improve their academic performance.



Note:

---------- : the sources that affect each other

———— : the sources that affect study anxiety

▬▬▬ : study anxiety that affect academic performance

Figure 2.3: The relationship of study anxiety and academic performance.

2.5 THE SUITABLE INTERVENTION FOR REDUCING ANXIETY

Anxiety intervention is appearing to play a useful role in the treatment of study anxiety, as it is not only an effective technique but also adds a significant component for the benefit of the training. The intervention is developed to reduce study anxiety in improving academic performance. Study Anxiety Intervention describes an assembly of physiological techniques and cognitive skills in reducing anxiety to improve academic performance.

The training represents a valuable program for students, university, and educational institutions. Academic services and educational intervention techniques might assist student in developing and maintaining a positive self-image by decreasing emotional problems (Soler, 2005). Breathing regulation can be very important as a self

regulation skill to reduce anxiety (Pierini, 2010). Institute of HeartMath (2004) proposed tips in reducing anxiety such as heart-focus and heart-breathing techniques which students learn to enter a state of psychophysiological coherence. HeartMath intervention has been shown to improve mathematics and English score (Institute of HeartMath, 2004). Study anxiety intervention has adopted the existing techniques and skills in reducing anxiety and improving students' academic performance.

The intervention technique involves a material in biofeedback training that help student cope with study anxiety to improve their academic performance. These can be classified into physiological techniques and cognitive skills. These techniques are aimed to give practical guidelines in reducing study anxiety as well in handling the time management. Desensitization of physiological techniques proposed in reducing the number of anxiety through slow breathing exercise, diaphragm breathing, relaxation, visual relaxation, and positive suggestions. These techniques consist with biofeedback techniques in handling psycophysiological disorders. Breathing exercises teach individual slow breathing using the diaphragm, researchers found that diaphragm breathing is a great way to reduce anxiety (Lehrer et al., 2004; Institute of HeartMath, 2004; and Pierini, 2010). Entirely using the diaphragm muscle to breathe automatically produces slow, deep, and smooth breathing (Lehrer et al., 2004). Relaxation is helpful to calm both mentally and physically (Pierini, 2010). A variety of relaxation techniques are useful to improve condition such as muscle relaxation, visualization, and music relaxation (Lehrer and Carrington, 2003). The techniques are used to produce a comfortable state in which students are more focused and more receptive to positive suggestions (Miller et al., 2006). The cognitive skills designed for students with distinctive study anxiety to provide them with in-depth knowledge, to enable them to apply the skills, to recognize the importance of study anxiety – academic performance relationship, and to learn their future opportunities. By practicing the intervention procedures, student can learn how to identify the unpleasant symptoms that appear with study anxiety and replace them with more relaxed feelings.

Basic intervention training is necessary to facilitate students in reducing anxiety to get back on his feet and continue to study without being anxious all the time. The intervention is expected to expedite anxiety reduction and also enhance

positive adaptive attitude associated to each of the study anxiety sources. This means that the intervention can contribute significantly to overall anxiety-reduction benefits. This intervention is also to help the students become more sensitive to the early symptoms of study anxiety to improve their academic performance.

2.5.1 Physiological Arousal

Individuals who experience of anxiety would likely to develop concerns about arousal related to physical sensation. Physiological arousal is defined by the American Psychological Association Dictionary of Psychology as aspects of arousal shown by physiological responses, such as increases in blood pressure and rate of respiration and decreased activity of the gastrointestinal system (Johnson et al., 2009). A subjective report of anxiety regulation effect was validated by additionally recording physiological measures and neural reactivity to pain (Kalisch et al., 2005). Other physiological effects of anxiety according to Johnson et al. (2009) include constricted blood vessels, elevated body temperature, increased dilation of the eyes, muscle spasms, raised blood flow to muscles, and decreased blood flow to the skin. Pougatchev and Pougatchev (2008) found that physiological arousal of anxiety is related by heart rate and breathing as reaction of the body. Heart rate should have the most profound oscillation synchronous with breathing, where the heart rate reaches maximum level at the end of deep inhalation and reaches minimum level on the end of exhalation (Pougatchev and Pougatchev, 2008). A number of interventions offered by biofeedback protocol have been designed to reduce anxiety with breath retraining; relaxation, music therapy, and visualisation.

Various forms of relaxation training have been used to restrain the detrimental effects of anxiety. Researchers have suggested using breathing therapy for the basic handling of anxiety due to physiological arousal (Lehrer and Woolfolk, 2007; McCraty, 2000; and Johnson et al., 2009). Lehrer and Woolfolk (2007) found that 75 percent of 1000 patients managed to reduce levels of anxiety and hyperventilation after the use of breathing therapy. Breathing is measured by way of lung function parameters such as rate, inhalation, exhalation, pauses, tidal volume, minute volume, flow, oxygen saturation, and end-tidal carbon dioxide (Lehrer and Woolfolk, 2007). The benefits of

breathing therapy, at the same time familiarizing with the habit of slower and deeper breathing, increases mental focus and attention (Lehrer and Woolfolk, 2007). Deep breathing can be defined as slow diaphragmatic breathing that balances out the oxygen and carbon dioxide levels in the body (Johnson et al., 2009). The purpose of breathing therapy is to enhance awareness by inducing marked improvement in the perceived quality of the natural rhythm (Lehrer and Woolfolk, 2007). Johnson et al. (2009) describes how important the use of diaphragmatic breathing that air inhaled through the nose and exhaled through the mouth, then by this body will react by subtracting the symptoms at the time of high anxiety.

One of the important aspects of breathing exercises is to make the students aware of their breathing hence lowering their heart rate. According to Lehrer and Woolfolk (2007) that the heart rate associated with breathing rate, where fast heart rate can be reduced by controlling breathing. According to Johnson et al. (2009) there are two particular techniques associated with deep breathing and relaxation, and it has been shown to effectively decrease anxiety levels. Relaxation techniques are commonly used across the physical and manual therapies as well as in various areas of psychological practice (Gill et al., 2004). According to Prato (2009), relaxation techniques are effective in reducing anxiety and activating the parasympathetic nervous system which will decrease heart beat and breathing rates. The purpose of relaxation is to help people gain cognitive control over the autonomic nervous system (Prato, 2009). These techniques can have an effect in increasing an individual's focus on the task with the reduction of their level of anxiety. Lower breathing rates contribute to the state of lower physiological arousal (Lehrer et al., 2004).

Physiological arousal will be decreased using the techniques of diaphragmatic breathing exercise (Heather and April, 2008; Lehrer and Carrington, 2003; Lehrer et al., 2004; Thurber, 2006; and Schiraldi, 2009), relaxation (Thurber, 2006; Peper, 1989; and Schiraldi, 2009), and visual relaxation (Peper, 1989; and Spevack, 1989). Respondents in this training were taught the technique of slow breathing and relaxation techniques in reducing anxiety. The physiological techniques for reducing anxiety are presented as follows:

a. Slow breathing exercise with diaphragm

Breathing has physiological and psychological effects but many people are not aware that proper breathing can reduce anxiety symptoms (Schiraldi, 2009). Breathing exercises are aimed at guiding the respondents to relax their sensations and release their anxiety (Pierini, 2010). To promote a relaxed feeling, the breathing exercises should not produce more than 12 breaths per minute. A relaxed breathing is slow, effortless, regular, fluid, and quiet, to master the slow breathing could take a person several months (Schiraldi, 2009). Learning to use proper breathing technique benefits the physical and emotional health in the long run. Breathing can also be used to affect the parasympathetic nervous system and the sympathetic nervous system as the cause of an anxiety feeling (Pierini, 2010).

Research has shown that proper breathing exercises can be very effective in reducing and preventing anxiety disorders. This can help a person feel relaxed and calm. There are two techniques of breathing: chest breathing and diaphragm breathing. Good breathing is through diaphragm breathing (Lehrer et al., 2004) because it will make the person feel more relaxed. This slow breathing is effective in reducing the anxiety level.

Diaphragm breathing is also known as abdominal breathing. Most people breathe with the chest and very few use diaphragm breathing (Schiraldi, 2009). Diaphragm breathing is effective in improving stamina, stimulating our minds, preventing lung infections and is rich in immunity cells. Slow diaphragm respiration is a very common technique used by practitioners to reduce the psychophysiological disorders (Gevirtz and Schwartz, 2003). This opinion is strengthened by Pierini (2010) who states that diaphragm breathing is better and healthier because it will block some of the abnormal patterns of anxiety. Most of the techniques to stimulate the relaxation response produce less tension, reduce levels of anxiety, are healthy, and give an overall sense of well-being. According to Schiraldi (2009) diaphragm breathing can improve relaxation and promote feeling of calm and comfort. He also cites that it may take several weeks before diaphragm breathing becomes automatic, and this can be achieved by exercising thrice daily, and five to ten minutes each time.

The diaphragm is the large muscle located between the chest and abdomen. To detect the respiratory diaphragm, one hand to place on the chest and the other on the stomach. The slow breathing instruction is explained in the training module (see appendix B) and Figure 4.1 presents the location of the diaphragm. Diaphragm breathing is an excellent technique to stimulate the relaxation response that results in less tension, reduced anxiety level, and overall sense of well being (Lehrer and Carrington, 2003).

Everybody has a unique number of breaths per minute, but the ideal number for individuals in relaxed conditions is approximately six breaths per minute (Lehrer and Carrington, 2003). Another opinion by Pierini (2010) states that a person in a relaxed condition has six to ten breath per minute, but breathing more than 12 breath per-minute is considered fast breathing.

b. Relaxation

Relaxation techniques have been used to combat the physical symptoms and psychological anxiety caused, by focusing the mind in a state of calm to reduce anxiety (Lehrer and Carrington, 2003; Greenfield, 1989a; and Martin, 2006). Relaxation is a very useful training for those who feel anxious. Justified and reasonable benefits from relaxation training include greater control, better mood, improved immune system function, the ability to think more rationally, and improved work efficiency (Schiraldi, 2009). Another benefit of relaxation technique is that it can help to reduce physical symptoms of anxiety such as tension, headaches, anxiety, and control the heart beat. The technique also teaches how to improve both physical and mental health as a guarantee of prosperity and success during the study.

Relaxation exercises are effective if done regularly. According to Schiraldi (2009), the exercise should be carried out during the relaxation skills training twice daily for ten to twenty minutes by focusing on one thing to improve sense of feeling. Schiraldi (2009) cited that those four to six weeks of relaxation training is usually effective to reduce the anxiety level.

c. Visual relaxation

The visual relaxation response is perhaps one of the most important skills that can be used to gain control over body. Another benefit of visual relaxation is it takes a lot of concentration and a lot of practice in order to fully master concentrating on the image and not being distracted by internal bodily discomfort or external noises (William and Carrey, 2003).

This technique aims to create a relaxed condition by imagining a place or an atmosphere such as a beautiful place, a beach, a mountain, a park, or a comfortable room. According to Spevack (1989) to start the visual relaxation one should choose a comfortable place then bring the body and mind to visit the place through imagination and feel the relax sensation.

2.5.2 Cognitive Anxiety

Cognitive anxiety is anxiety that interferes with students' performance through memory blocks, concentration, attention, resources, or mere cognitive interference from worries and fears. According to Gill et al. (2004) cognitive anxiety can be caused by negative expectation and negative self expectation. Cognitive anxiety is defined as the mental part of anxiety caused by negative expectation of outcomes or a negative self evaluation (Robb, 2005). Another description of cognitive anxiety that it is considered to be of negative concerns and self-doubt in relation to performance (Fazey and Hardy, 1988). Cognitive factors are known to raise anxiety levels including one's reaction to lack of control, such as lack of confidence, shyness, lack of concentration lack concentration, and failure in examinations.

A previous study found cognitive symptoms of anxiety include fear of making mistakes, feelings of inadequacy, worrying about things happening, and studies also have indicated that high levels of anxiety are related to low levels of confidence (Miller, 2009). More specifically, effectiveness theory predicts that cognitive anxiety must provide more effort in the task to perceive a reasonable chance of success (Hardy and Woodman, 2003). Cognitive anxiety is addressed by using State and Trait (STAI)

instrument. Research finding that high level of state and trait scores determines high level of cognitive anxiety (Spielberger, 1983; Cassady and Johnson, 2002; and Prato, 2009). The state is the interpretation of anxiety situation at a particular period of time or at the moment of feeling, and trait anxiety is the differences that characterize people's anxiety or general feeling of anxiety (Spielberger, 1983).

Cognitive skills for managing anxiety are powerful means of reducing intense anxiety, and this can be achieved by a few minutes of focusing on diaphragm breathing (Westermeyer, 2002). This skill is designed to reduce anxiety by improving mental ability in order academic performance enhancement. In addition, it seeks to help students in improving their confidence level, to motivate them, to be more aware of themselves and their surroundings, and to reduce mental illness. Students can learn to identify and handle the sources of their study anxiety. Components of cognitive skill include study anxiety coping skill, resource management skill, time management skill, learning strategies skill, and study skill. The table below explain the previous work of intervention related with the anxiety source for students.

Table 2.1: Previous studies on anxiety intervention

Study Anxiety Sources	Author	Intervention
Exam anxiety	Miller et al. (2006)	Stretch-tense-deep breath-release and relaxes.
	Pecararo (2006)	Study skills and motivation to treat exam anxiety.
	Institute of HeartMath (2004)	Practice test training other than academic approaches that prepare students for taking standardized tests.
Language anxiety	Kenneth and Malvin (2008)	Cognitive restructuring, written reflection, relaxation training, skills and strategy training.
	Dianne (2003)	Self help and clinic-run treatments (include getting involved in support groups, improving study skills, learning self management, and self awareness of personal learning style), attending

		tutorial, and applying relaxation technique.
Mathematic anxiety	Institute of HeartMath (2004)	Facilitates the higher cognitive processes critical for focusing attention, reasoning and creativity for students.
	Puteh (2002)	Used training college in helping trainees to identify and then modify in reducing mathematics anxiety.
Social anxiety	Cooley (2007)	Cognitive-behavioural therapy can help these students be more creative in thinking. Calming and relaxation techniques may also help students manage anxiety.
Family anxiety	Jane (2002)	A positive support from family and maintaining good relationships between family members
Presentation anxiety	Murugesan (2006)	Avoiding anxiety during presentation with adequate preparation.
	Greenfield (1989a)	Take slow breathe to turn anxiety
Library anxiety	Carlile (2007)	Focus on how to make students feel more comfortable using the library, skills and information to increase students' confidence and knowledge.
	Ansari (2009)	Satisfying the information needs of students would be assumed to reduce the level of library anxiety.

Resource management skill teach the students to explore self regulation effort in overcoming learning difficulties; the second is asking peers for assistance, and the last one is meeting with lecturer or someone else to seek help to solve the problem. This refers to students' effort to study independently. For example, they should do their own

assignments instead of copying from friends, hence participating in the learning process.

Learning strategies skill aim to teach students of strategies to reduce the anxiety associated with learning difficulties in improving their academic performance. According to Sansgiry et al (2006), learning strategy is defined as the knowledge and application of effective study skills or techniques by students. These skills were adopted from Ferwick and Rosa (2006), such reading skills, study reviews, weekly reviews, studying on weekends to complete the homework or assignments, and note taking as a structure for organizing relevant information (Ferwick and Rosa, 2006). Consequently, study group is a great way to retain information between students (Charlotte, 2004). The studies will be effective in study groups for students to enhance their ability to learn. Study groups also provide opportunities to collaborate with other students on difficult subjects, to get explanations from different perspectives, and learn to help other students. For the examination preparation, the skill includes preparation before examinations, during examinations, after the examination, as well as providing information on nutrition for the body and mind during their duration of examination. Institute of HeartMath (2004) has suggested eight test smart strategies such as reading the directions twice and reading the questions carefully, spacing difficult questions, and marking the answers clearly. And the last skill provided is improving concentrations and memory, these skills teaches student with re-reading the materials frequently. Student will easily remember and understand their lessons. Studying at the last minute is not recommended.

Time Management Skill, the skill is taught students had ability to manage their schedules effectively. Dalton et al. (2003) appealed to the problem of student time allocation in the motivation of study. The skills are efficient as the ability to manage schedules effectively and balance their time between academics and social activities among engineering students (Amenkhienan and Kogan, 2004). Generally, time management is a tool to save time, as an organizer, to address of tasks, remind important dates, or get more benefits for improving human life (Dalton, 2003; Nonis and Hudson, 2006). Time management for students is the ability to manage schedules effectively between academic activities and extracurricular or non-academic activities.

A previous study found that lack of time management skills is one of the issues that affect students' academic performance (Laura, 2001). Amenkhienan and Kogan (2004) found that students who have a high GPA are able to identify problems with time management and make alternative choices when compared to other students. Academic performance and satisfaction are the greatest benefits when students apply time management. Students learn time management skills, starting with identifying their daily activities then making weekly schedule. The intervention suggests respondents to spend a minimum of two hours of self study for every hour of formal study (lectures and classes). The two hours of self study is to review the materials received in the formal study. Self study time is a positive and significant determinant of performance, but has a much smaller coefficient than the time spent in formal university study (Dalton et al., 2003).

Study Skills, to be successful in studies requires high motivation, lots of effort, strong study skills, effective time management, and good examination strategies. Study skills provide tips to learn the tricks toward success. This training does not recommend students to learn at the last minute before the examination. An effective way to study is to spend at least two hours of self-study reviewing for every hour of materials, equivalent to one credit hour, studied in class. The study anxiety intervention in biofeedback training is useful if student is willing to take the time to practise those skills continuously and regularly.

The intervention are described in detail in the appendix A and appendix B, that was designed to be easy to learn with more display of images, simple instructions, colourful to make the respondents interested in learning the intervention. The intervention was already copyrighted (appendix R**).** Similar intervention designed by HeartMath called TestEdge, however the biofeedback intervention program have a slightly different technique though with TestEdge (appendix K). As the following to employ the biofeedback device and application the biofeedback techniques, the researcher has attended the online biofeedback training and was certified by Biofeedback Foundation of Europe (appendix L).

2.6 BIOFEEDBACK TRAINING IN REDUCING ANXIETY AND IMPROVING PERFORMANCE

2.6.1 Definition of Biofeedback Training

In the context of study anxiety, biofeedback training is an educational process to learn specialized mind/body skills to recognize how the body functions and to control patterns of physiological functioning (Stephen, 2001). The biofeedback training consists of a set of intervention techniques, skills, and equipment. According to Chaves (1997) biofeedback is a technique to learn deliberate control of physiologic functions of which people are usually not aware, the purpose of recovering, to maintain or to improve the health as well performance**.** The biofeedback trainer uses information from the feedback in order to change subject into more desirable level. Many therapies offer physiological relaxation, but some observers perceive biofeedback as a specific treatment modality within groups (Schwartz and Andarsik, 2003). Green (2001) maintains that biofeedback is a treatment technique in which people are trained to improve their health using signals from within their own bodies.

The term biofeedback was familiar back in the 1960's when laboratory researchers were studying the potential of an individual consciously having changes in his blood pressure, heart rate, and other bodily functions. The use of technology in biofeedback has occurred approximately in the last twenty years. A variety of health problems has been explored in the field of biofeedback, such as muscle tension, hypertension, phobias, stress, and anxiety. Biofeedback or applied psychophysiological feedback is a subject-guided treatment that teaches an individual to control heart beat, respiration, brain waves, and other bodily functions through breathing exercise, progressive relaxation, visualization, concentration, and other cognitive control techniques.

In a multidisciplinary training program, biofeedback is a powerful tool to enhance performance that the biofeedback training can facilitate to illuminate the importance of mental training, monitoring, and encouraging the learning of psychophysiological control that is necessary for peak performance (Peper, 1997).

Currently, biofeedback is being used in many areas, not only for clinical purposes but also for the enhancement of music performance, student performance, sports performance, and work performance (Thurber, 2006; Institute of HeartMath, 2004; Sutarto and Abdul Wahab, 2008; and Robb, 2005). The types of biofeedback that are used for biofeedback training include (Pierini, 2010; and Chaves, 1997):

a. Electromyographic (EMG) sensors which measure electrical activity in the muscle especially on muscle tension.
b. Galvanic Skin Response (GSR) sensors which are electrodes that are placed on the finger to monitor perspiration and sweat gland activity.
c. Respiratory sensors which monitor oxygen intake and carbon dioxide exhalation, and detect slow diaphragmatic breathing.
d. Electrocardiograph (ECG) sensors which measure and control heart frequency, arterial pressure, and respiratory biofeedback.
e. Electroencephalography (EEG) sensors which are electrodes to measure the electrical activity of the brain or brain waves.

Biofeedback is a fundamental requirement for proper training in human psychophysiology as a specialized course for the achievement of knowledge, and the development of skills in the practice of the biofeedback therapy (Chaves, 1997). The advantages of biofeedback therapy as explained by Chaves (1997), when compared with other kinds of treatments such as treatment with drugs, is that biofeedback does not present side effects; also the subjects has the control of the evolution of the therapy and feel no pain during the therapy. Biofeedback training is not only a healing but also an educational process that causes a modification of habits and behaviours leading to the reorganization in the life of the subjects and the improvement of their performance in life.

2.6.2 Biofeedback Training Effective in Reducing Anxiety

Biofeedback is one of most useful adjuncts in treating physiological hyper arousal both episodic and chronic as seen in anxiety disorder (Brauer, 1999). Yucha and Gilbert (2008) reported that randomized studies have shown biofeedback to be superior

to other relaxation and self control methods for reducing anxiety. One way of relieving anxiety disorders symptoms is through biofeedback therapy (Martin, 2006). Most of the knowledge gained about biofeedback is the result of medical studies, where individuals have been trained to self-regulate their bodies by intentionally changing physiological processes using signals that are fed back from their own bodies (Robbins, 2000).

Biofeedback operates on the theory that performance or reflex responses can be controlled when the subjects are trained to respond to physical changes in their bodies. The general principle is that biofeedback could be used to teach arousal reduction, which should benefit the anxious, over aroused individual (Kathleen et al., 1993). Biofeedback can assist in slow breathing exercise and relaxation used to reduce anxiety with the effect of modifying the autonomic nervous system by decreasing physiological arousal (Prato, 2009). There are several different underlying problems which cause high levels of anxiety. Biofeedback can help each of the problems for different reasons (AAPB, 2004):

a. Breathing problems which cause anxiety: Most of these people are not aware they have incorrect breathing patterns because they habitually breathe too rapidly. These incorrect patterns are easily detected using psychophysiological assessments and corrected using several types of biofeedback therapies related to helping people normalize their breathing patterns. When the breathing is normalized, the anxiety goes away.
b. Biofeedback treatments can show the abnormal physiological response levels of a person who experiences high levels of anxiety. The subject can then use biofeedback techniques to recognize anxiety, learn to identify what is actually causing the anxiety, and how to control them.

Biofeedback training is used in relaxation therapy to overcome anxiety. The training has been successful on people who are willing to make improvements in their life style (Page, 2004). Some observers perceive biofeedback as a specific treatment modality with practiced relaxation, in which the effect of relaxation has a major role in achieving the biofeedback treatment (Schwartz and Andarsik, 2003). A previous study related with biofeedback to cope with anxiety in peak human performance was

presented in many areas such as the enhanced creativity which musician may experience through somatic studies and biofeedback training through greater relaxation, decreased performance anxiety, and improved concentration (Johnson, 1987). Biofeedback training has a large effect at decreasing mental, emotional and physiological symptoms of music performance anxiety among university students (Thurber. 2006). Another study showed that the respondents who received biofeedback training is shown significant improvement in their performance compared to the control respondents (Strack, 2003). Also, the biofeedback group had significantly lower post test states anxiety and trait anxiety (Brauer, 1999). These results illustrate that biofeedback training are effective in regulating anxiety and improving performance.

Anxiety, influenced by the Sympathetic Nervous System (SNS), affects the heart rate and respiration (Pierini, 2010) and anxiety increases with increasing heart rate (Papageorgiou and Wells, 2000). Some researchers suggested that slow breathing will produce slow heart rate (Lehrer and Woolfolk, 2007; and Pierini, 2010). Page (2004) reported that the effect of biofeedback can be measured by tracking the heart rate and the breathing rate. This study used Electrocardiograph (ECG) sensors to measure heart rate (beat per minute/BPM) and respiratory sensor to measure breathing rate (breathe per minute/bpm) with the diaphragm breathing type used as the control (Chaves, 1997). The sensors used in enhancing breathing and heart beat awareness are explained below.

a. Respiratory sensor

The sensor measures the average number of breathing rate with unit of measure is breathe per minute (bpm). The idea of slowing the breathing to 6-10 breaths per minute is what most people learn initially when taught on respiration and heart rate (Champbell, 2005). Another opinion suggested that people in relaxed conditions has 6-10 breath/minute, and those with faster breathing, an abnormal pattern due to anxiety, have an average of 12-20 breath/minute (Pierini, 2010). One standard goal is slowing respiration to about 6-8 breath/minute, much less than 12-15 breath/minute which is typical for most people, and some practitioners strongly recommend 3-5 breath/minute (Gevirtz and Schwartz, 2003). According to Clark and Hirschman, a typical breathing rate of 16 breath/minute is a rate often associated with anxiety (Gevirtz and Schwartz,

2003). Through breathing, the respiratory system inhales oxygen (O_2) and exhales carbon dioxide (CO_2). Breathing slower, deeper and longer tends to produce an optimal balance between levels of O_2 and CO_2 in the blood. Proper breathing tends to reduce anxiety, produce a feeling of calmness, and decreases the rate of breathing in general. Respiration can also control emotional levels (Pierini, 2010).

Respiratory sensor measures breaths per minute, and simultaneously monitors both thoracic and abdominal respiration patterns, analyzes, and displays to the respondents information regarding their own respiration. With breathing exercise, the self regulation of respiration rate should be no more than 6 – 10 breath/minute. Breathing exercises are focused on instructing the subject to achieve slow breathing using the diaphragm. The respiratory sensor is shown in the Figure 2.4.

Figure 2.4: Respiratory sensor

b. Electrocardiograph (ECG) sensor

The device measures the average number of heart rate with unit of measure is beat per minute (BPM). A healthy and relaxed person normally has between 70 - 80 beats per minute (McKinney and Gatchel, 1982). Kulkarni (2010) found that healthy resting heart rate for men is between 60 to 75 BPM, and is between 60 to 80 BPM for women. Heart rate changes play a large role in the physiological component of anxiety

(McKinney and Gatchel, 1982). Brauer proposed that heart rate reactivity has been argued to be one of the most relevant physiological arousal in the anxiety research, and in general, the increase of heart rate is a physical symptom of anxiety (Stewart, 1999). Anthony in Stewart (1999) suggested that fear of anxiety may indeed be related to the enhancement of cardiac sensitivity. When a person is relaxed, his heart beat at a slower pace. On the other hand, when a person is anxious his heart beat speeds up. By doing diaphragm breathing exercises, relaxation, and visual relaxation, a person can slow down his heartbeats to 70 beat/minute. The ECG sensor is shown in the Figure 2.5.

Figure 2.5: electrocardiograph (ECG) sensor

2.6.3 Biofeedback Training to Improve Students' Performance

Educational institutions have examined many different techniques in trying to enhance students' academic performance. This study proposes to improve academic performance of students using biofeedback training. Educational research on biofeedback suggests that biofeedback training can help students learn to prevent unpleasant and uncomfortable feeling, and enhance emotional intelligence as well greater capacity for learning (Stephen, 2001). Biofeedback training is a set of intervention techniques that helps to reduce anxiety in improving academic performance and bring about a positive outlook when students are involved in their multi tasks. Students who have an awareness of their psychophysiological states during study would be able to improve their attention as in the case of test anxiety (Stephen, 2001). The

training gives students a skill in reducing anxiety, improve mental and physical abilities, and academic performance enhancement.

Nowadays, biofeedback is used in academic probation program for students. According to Moss (2003) biofeedback is a useful tool and is simple to use with the training procedures available so students can learn self regulation skills that can be applied after the training by student to enhance their academic performance. Prior studies found that biofeedback is effective in improving performance among students. Al Shamari (1991) suggested that biofeedback is effective in decreasing students' EMG level. Higashiyama et al. (2006) conducted electromyograph (EMG) biofeedback therapy for writer's cramp, this was to compare between writer's cramp patient and healthy university students. The 4-channel EMG feedback was performed on healthy university students to verify and compare with the reaction of the EMG in patients diagnosed with writer's cramp. Respondents received therapeutic of the EMG biofeedback. Results found that the writer's champ patients were able to control their extensor muscle cramp radials lounge in writing letters to the same intensity as the healthy university students were doing. Moreover, result proves numerical value of the EMG was reduced among healthy university students, and the effect of the EMG biofeedback was able to be confirmed.

A preliminary study was undertaken to assess of heart rate variability (HRV) biofeedback training to improve cognitive performance among university students (Sutarto and Abdul Wahab, 2008). The training evaluated nine female undergraduate students during six sessions. As appraisal of training progress, the HRV was assessed by using Biofeedback Stress Management Kit. Biofeedback group learn diaphragm breathing to produce low frequency of heart rate variability. Results of pre training were compared with of the post training between biofeedback group and control group. The biofeedback group show increase in several cognitive functions and decrease of the low frequency of heart rate activity.

Another biofeedback study for students was conducted by McCraty et al. (2000). A total of twenty high school seniors took the MBST in reading or math in the spring training camp. The program designed to reduce test-taking anxiety and prepare students

mentally and emotionally, as well as academically. Students regularly practiced the Freeze-Frame (the HeartMath biofeedback tool) and Heart Lock-In techniques. In addition, the students were placed into two groups such HeartMath group and control group with pre and post test. After completing the program, in 25 hours of instruction over 3 weeks, the HeartMath group had shown significant reductions in symptoms of psychological distress experienced from pre to post- training compared to students in an untrained control group. Furthermore, HeartMath group showed an average 35% improvement in Math and 14% gain in reading test scores.

Budzynski et al. (1999) conducted training to test the possibility of Biolight, combined of audio/visual stimulation (AVS) and EDR feedback device, changes positive in academic performance. The university students were divided into two groups, 30 sessions for the experimental group and no session for the control group. All subjects were given pre-post testing consisted of a Psychophysiological Stress Profile (PSP). The PSP included measures of an electroencephalograph (EEG) activity, finger temperature, an electrodermalgraph (EDG), and heart rate. Results appeared to generate sufficient change in the physiology of the students to improve academic performance more than the control group.

The abovementioned studies used biofeedback as part of larger intervention program hence it is difficult to determine biofeedback's true effect on students' performance. Furthermore, some evidences were presented from related studies which at least partially support this study. Biofeedback also improves student achievement index in test performance as well it was effective in reducing test anxiety (Prato, 2009). Besides, biofeedback enhances study skills when students learn to control their mind/body activity (Stephen, 2001), and it assist self regulation training to decrease anxiety level among college students (Champbell, 2005). Researches by HeartMath have found that Biofeedback training is a powerful tool to assist students in using emotion focused techniques effectively and learning to self generate increased coherence (McCraty, 2005; Wilrich, 2007; and Arguelles et al., 2003). Another research by HeartMath reported that after training 75% of the students' have reduced their test anxiety, have improved emotional well being, classroom behaviours, learning and academic performance (An overview of research, 2000). The Kansas University

provides biofeedback training centre to give specific training in terms of biofeedback techniques, equipment, and counselling skills to help students develop self-regulation skills in areas of performance enhancement and stress management (K-State, 2007). Biofeedback is also used as an alternative medicine in colleges to overwhelm drugs, Attention Deficit Disorder/ADD, aggressive behaviour, and cardiovascular problems (Page, 2004). The duration of a training session depends on the condition of the respondents. Usually on five to six weeks is the minimum duration but may take several months, and for some individuals with physical problems could take even longer (K-State, 2007).

Biofeedback studies have been conducted in elementary schools, middle schools, high schools, and colleges and are found to be able to improve emotional well being, classroom behaviour, learning, and academic performance among students (Arguelles et al., 2003; and Thurber, 2006). However, in this study biofeedback is used to help students prepare themselves mentally and physically for anxiety during their studies. Students use these techniques to manage study anxiety apprehension to enhance academic performance.

2.7 SUMMARY

This chapter presents a detailed explanation of the relevant literature available on the topic. Previous studies have found specific types of anxiety among students, and this was necessary to understand the sources of anxiety in order to develop the interventions and to deliver the instructions during training. These sources include exam anxiety, language anxiety, mathematical anxiety, social anxiety, family worries, presentation anxiety, and library anxiety. Researchers found that high anxiety effect on poor performance. Generally, the relationship between anxiety and academic performance is established.

In reference to the theoretical framework, anxiety is seen into physiological arousal and cognitive anxiety that was effect on academic performance. The main goal in this study is to examine the effect of biofeedback intervention program to reduce anxiety in order to improve academic performance. Engineering students is required

suitable intervention to improve their academic performance. Moreover, the intervention program was designed into two components, which are a comprehensive of physiological techniques and cognitive skills.

Physiological techniques which are used in this study are existing techniques from biofeedback training, which is commonly used in reducing psychophysiological disorders. This component consists of slow breathing using the diaphragm, relaxation, and visual relaxation. The first technique used the diaphragm breathing exercises to produce slower breathing and are effective in reducing levels of anxiety (Moss, 2003; Lehrer and Carrington, 2003; Lehrer et al., 2004; Pierini, 2010; and Schiraldi, 2009). The second technique utilized the relaxation (Schiraldi, 2009) and visual relaxation to increase relaxed feelings (Pierini, 2010). Finally, the third technique was to control the heart beat since when someone is in a state of anxiety, his heart beat is faster than normal. These physiological techniques are aimed at making the students feel comfortable during study as they contain elements of relaxation to eliminate the uncomfortable feeling between them.

Cognitive skills - this component focuses on the causes of study anxiety, resource management skills strategies, study skills, learning strategies skills, and time management skills (Fenwick and Rosa, 2006; Soler, 2005; and Elsie, 2000). Materials were taken from a previous study which is related to this research, and then it was modified into easy-intervention techniques for students to learn. This training was of interest to students who wanted to improve their academic performance but had not learnt any techniques to cope with study anxiety.

Therefore it can be concluded that anxiety has an effect on academic performance and there is not enough studies find on reducing anxiety as well as to improve academic performance for engineering students in the university. Consequently, a suitable designed intervention which related to the problem is required. Moreover, biofeedback training is effective to help students prepare themselves mentally and physically for anxiety during their studies. Through biofeedback training, students can learn the intervention technique to reduce anxiety in improving academic performance. The research methodology will be discussed in the next chapter.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The purpose of this study is to assess the effect of biofeedback intervention program in reducing anxiety to improve academic performance among engineering students. The effects of this intervention were investigated on physiological arousal, cognitive anxiety, and academic performance. This chapter presents the research methodology that comprises of introduction, research framework, research design, population and sampling, research process, instruments, method of collect data, data analysis, pilot study, and summary.

3.2 RESEARCH FRAMEWORK

The research framework incorporates some significant components about the identification study anxiety sources, determine of relationship between anxiety and academic performance among engineering students, design the suitable intervention, and examine the effect of biofeedback intervention program to reduce anxiety in the improvement of academic performance. The biofeedback method was used for research design with pre post training is measured. The flowchart of research framework can be illustrated in Figure 3.1 as the following.

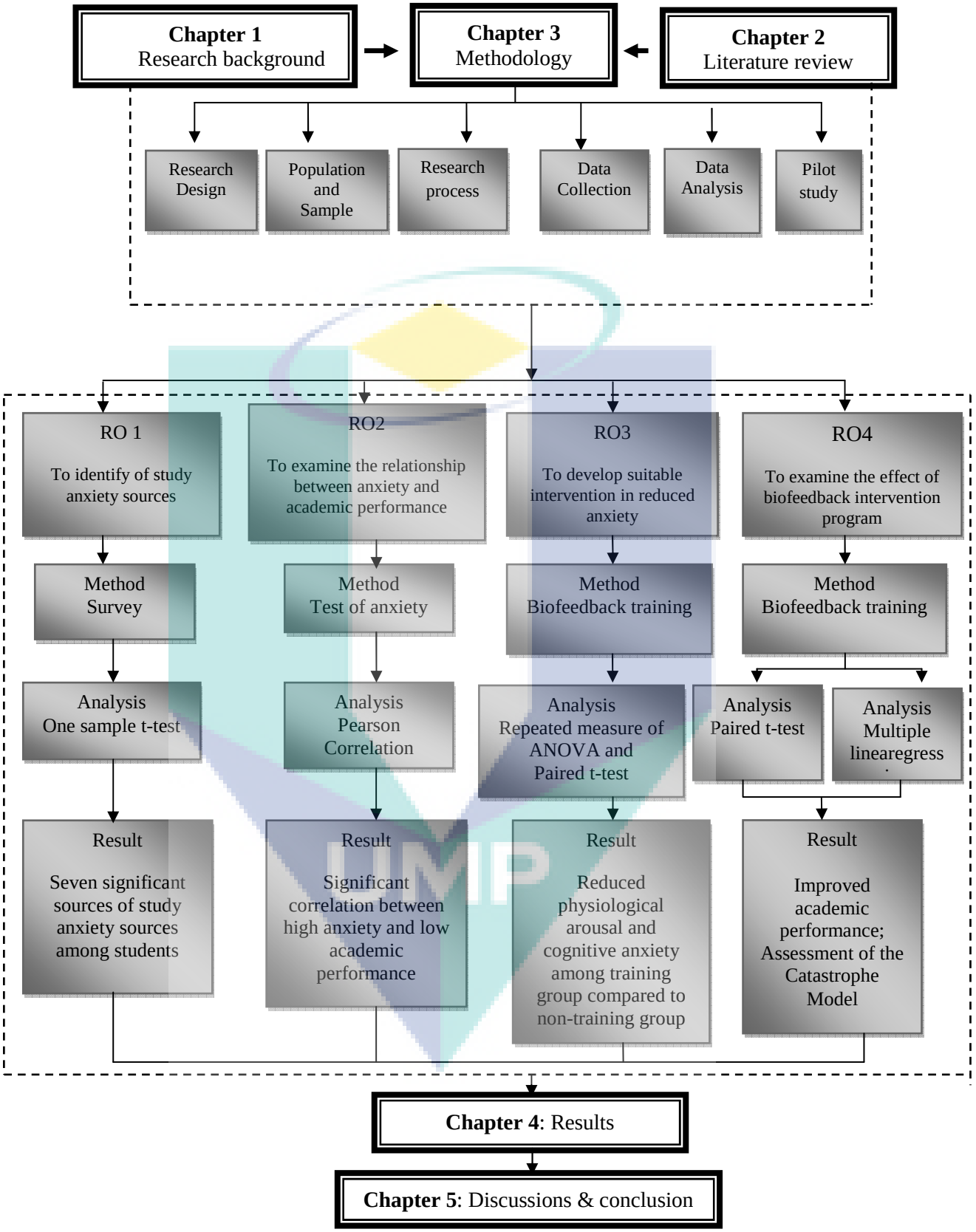


Figure 3.1: Research framework

3.3 RESEARCH DESIGN

The research design used biofeedback method with pre-post test design in two time intervals (pre-post) involving two groups of respondents (training and non training group). The respondents take a series of tests in the beginning of a program (pre test) and then again at the program's completion (post test). Dugard and Todman (1995) mentioned that pre-post test design is well suited to investigate effects of educational innovations and such test designs are common in educational research. Another opinion cited by Shaughnessy et al. (2006) is that randomly assigning subjects is an example of a good experiment for averaging students in the two groups. Random assignment to conditions is used to form comparable groups by averaging subject characteristic across the conditions of the independent variable manipulation (Shaughnessy et al., 2006).

The design was supported by biofeedback studies which the respondents placed into two groups (treatment group and non treatment group) with pre post test design. In similar study, Thurber et al. (2010) was placed 20 musicians from university students into treatment group and control group with pre-baseline and post-baseline test. Respondents in the treatment group received full training session in heart rate variability coherence biofeedback training and emotional refocusing techniques to decrease music performance anxiety. Budzynski et al. (1999) was designed pre post test for the experimental group and the control group, each for 8 students. The training aimed to examine the possibility of Biolight would be positive changes in academic performance among university students. The experimental group received 30 sessions and the control group received no training. All subjects were given pre-post physiological stress profiles and EEG biofeedback testing. Evidence was presented from a number of related studies which at least partially support this study (Arns, 2009; McCraty et al., 2000; Sutarto and Abdul Wahab, 2008; and Berman, 2001).

The respondents are randomly assigned into training group and non-training group. Both groups addressed the independent and the dependent variable listed in the research question and hypothesis stated above. The characteristics of the respondents are matched between groups which include age, semester of study, engineering students, healthy students, high level anxiety, and low academic performance. This study seek for

significant differences in pre post training between training group (full intervention) and non-training group (no intervention). The designs are frequently analysed by Paired sample t-test to compare mean in pre post training between groups, and a repeated measures ANOVA to test the treatment by time changes in heart rate and breathing rate. The design presents in figure 3.2 as follows.

	Pre-test (P_1)	Training	**Post-test** (P_2)
The training groups	O_1	X	O_2
The non training groups	O_3		O_4

Where: O_1: pre-test of the training group

O_2: post test of the training group

X: intervention

O_3: pre-test of the non training group

O_4: post test of the non training group

Figure 3.2: Pre post training design

Source: Shaughnessy et al. (2006).

3.4 POPULATION AND SAMPLING

3.4.1 Population

The population in this study are engineering undergraduate students in Universiti Malaysia Pahang (UMP). The engineering students were selected for this study which aims to help improve students' academic performance as well to support academic probation program for biofeedback centre at the university. As of January 2008, the population were approximately 3,726 students. Engineering students were selected as respondents for the reason that there are many problems come up in everyday life which

create of study anxiety. These problems were including due to the technical courses, too much emphasis on individual work, level of academic competition, frustrated and dissatisfied with their academic performance, a lot of assignments, social integration, attitude, and motivation problems (Amenkhienan and Kogan, 2004; (Kolmos and Holgaard, 2008; Ercani et al., 2008).

3.4.2 Sample

In the first stage, cluster sampling was used to classify students into the same category for the survey. Respondents are chosen from those who are enrolled in 1st year engineering undergraduate program in the 2008/2009 academic year. Selection was restricted to degree-level students because they have a longer of time of study in the university and their population is greater than that of diploma students who only have three years of study. Therefore, 1st year students were selected based on the previous studies that 1st year student's experience high anxiety (Bolden, 2008; Margarita, 2008). A total 770 first year students participated in this survey; students who were absent during the survey were excluded from the sample. In the second stage, students with low academic performance received STAI to determine their anxiety levels. A total 205 students with low academic performance participated in this test, which also aimed to select respondents for biofeedback training. The result found that 194 students have low academic performance (GPA < 2.51) and high level anxiety (STAI > 80). Table 3.1 presented the interpretation of STAI and GPA level.

Cluster sampling also used to select the respondents for biofeedback training. Then the clustering was collected from the category of high anxiety and low academic performance among engineering students at UMP. From 194 students that fulfilled the stated requirements, only 70 students were available to participate in the study. The respondents were randomly divided into two groups, those with odd numbers selected as the training group, while those with even numbers selected as the non training group. The small size of sample was supported by the previous studies in the biofeedback literature (particularly dissertation), sample usually limits to size varies from 8-43 (Matuszek, 1999; Tanis, 2008; Thurber, 2006; and Strack, 2003). With limited of

sample size, however the previous finding show decrease variance of physiological arousal. Figure 3.3 presents the sample selection procedure.

Table 3.1: Interpretation of STAI and GPA Level

STAI's score	GPA	Interpretation
STAI < 80	GPA < 2.51	Low
STAI > 80	GPA > 2.51	High

Source: Spielberger et al. (1993); and Universities document (2009).

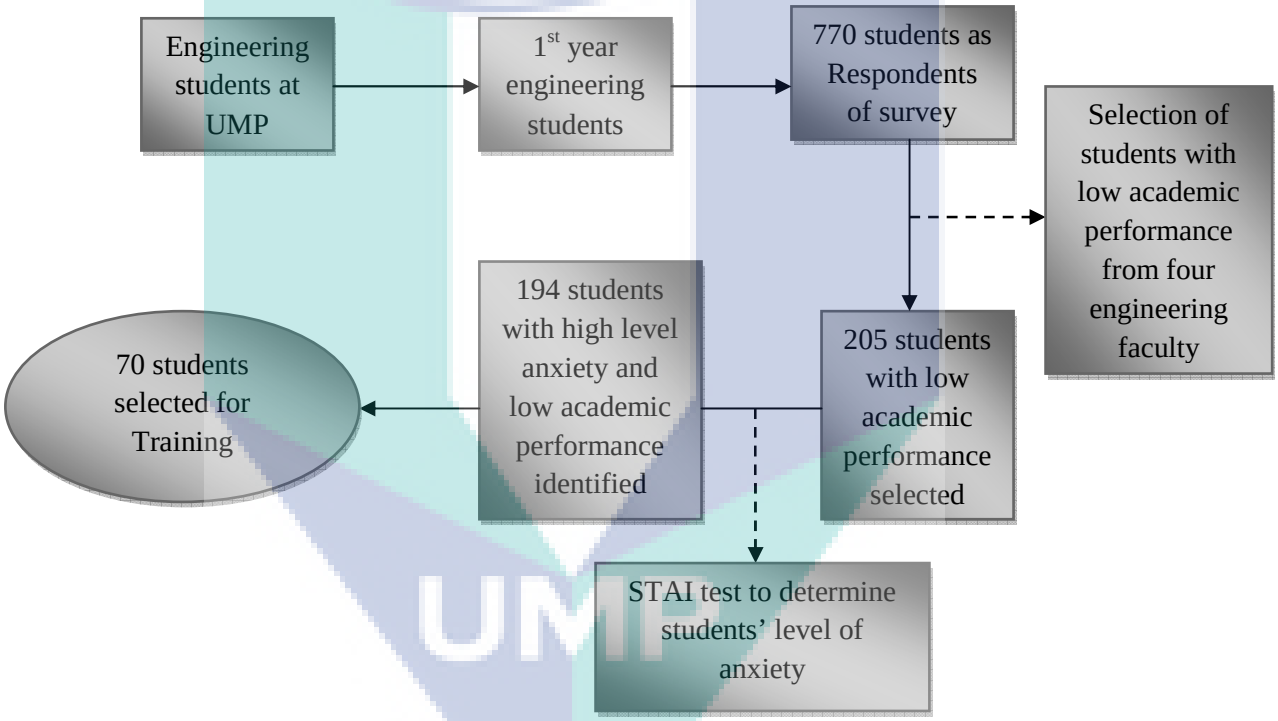


Figure 3.3: Sample selection procedure

3.5 RESEARCH PROCESS

The research process presents procedures in this study which include a preliminary survey, and biofeedback intervention program. The process is described as follows.

3.5.1 Identification of Study Anxiety Sources

The research process in this study started with a survey to identify sources of study anxiety. The survey was aimed at recognizing the possible sources of study anxiety and their effects on academic performance among engineering students. The sources of study anxiety that has been found used in designed the intervention.

The survey was conducted in the classroom, with 25 to 30 respondents per class, took approximately five weeks to complete the survey. The students asked to read the survey questionnaires, and if they do not understand any question, the researcher was to explain the question. The students were asked to answer basic questions related to their feelings, experiences, thoughts and anxieties associated with their studies and academic performance. Based on observations during the survey, this study found that students were not aware that their study anxieties have negative impact on their academic performance.

3.5.2 Biofeedback Intervention Program

This program was conducted in ten sessions that lasted for one semester throughout the month of August until November 2009; each session lasted two hours (from 10.00am to 12.00am and from 02.00pm to 04.00pm on Saturdays and Sundays). Most studies found significant reduction of anxiety and improvement the mental ability during six to twelve sessions of biofeedback training, with more complex problem requiring more sessions. (Heckman, 1998; Brauer, 1999; Bruce, 2000; Thurber, 2006; Soler, 2005; and Annette, 2009). Another finding found that required several months to treat students' anxiety (K-State, 2007). Moreover, the ten sessions was consist with Lehrer et al. (2000) that they was designed 10-week HRV biofeedback protocol to implement with the participant and conducted at a university lab. Each session lasted 45-60 minutes, included five minutes recording. Sessions 1, 4, 7, and 10 served as recording sessions (Lagos et al., 2008). The advantage of using the laboratory is that irrelevant variable may be can control (Hunt, 2008). The control aimed that there may be less interference, less confusion, less number of errors, and making it less

complicated to obtain significant results. The biofeedback intervention program explained in the selection of training respondents and training process as the following.

a. Selection of Training Respondents

The respondents consist of these who have low academic performance received STAI test to measure anxiety. This study was using STAI scores as confirmed by Spielberger (appendix S) to determine the anxiety level with a reason that the anxiety is better when seen with a combination score of state (at this moment feeling) and trait (general feeling) rather than a single value only. The STAI has 40 questions and takes approximately 20 minutes to complete. Subsequently, the respondents were asked to complete the form on demographic information concerning in the previous semester's GPA, gender, age, health problems, and learning problems. The entire are intended for screening in order to choose the healthy students as training respondents, while students who have health problems not included in this training. This study is to select students who are healthy as training respondents. After two weeks, those students with high levels of anxiety and low academic performance were offered to participate in this training. The result of the test will be used to find out correlation between anxiety and academic performance.

Seventy students are chosen to be respondents in the biofeedback intervention program whom were confirmed that they do not receive any interventions before. They were randomly assigned into training group and non training group, thirty-five each group. Respondents must first sign an ethical approval letter (appendix N) before involving in this training. The training group was given intervention for ten sessions, learning the related techniques. However, the non-training group did not receive any intervention and was present at the pre and posts test only. Based on the information from the pilot study, the non-training group were not allowed to attend the training so as to avoid bias effect of intervention. No placebo effect is used in the training. Figure 3.4 presents the selection of training respondents.

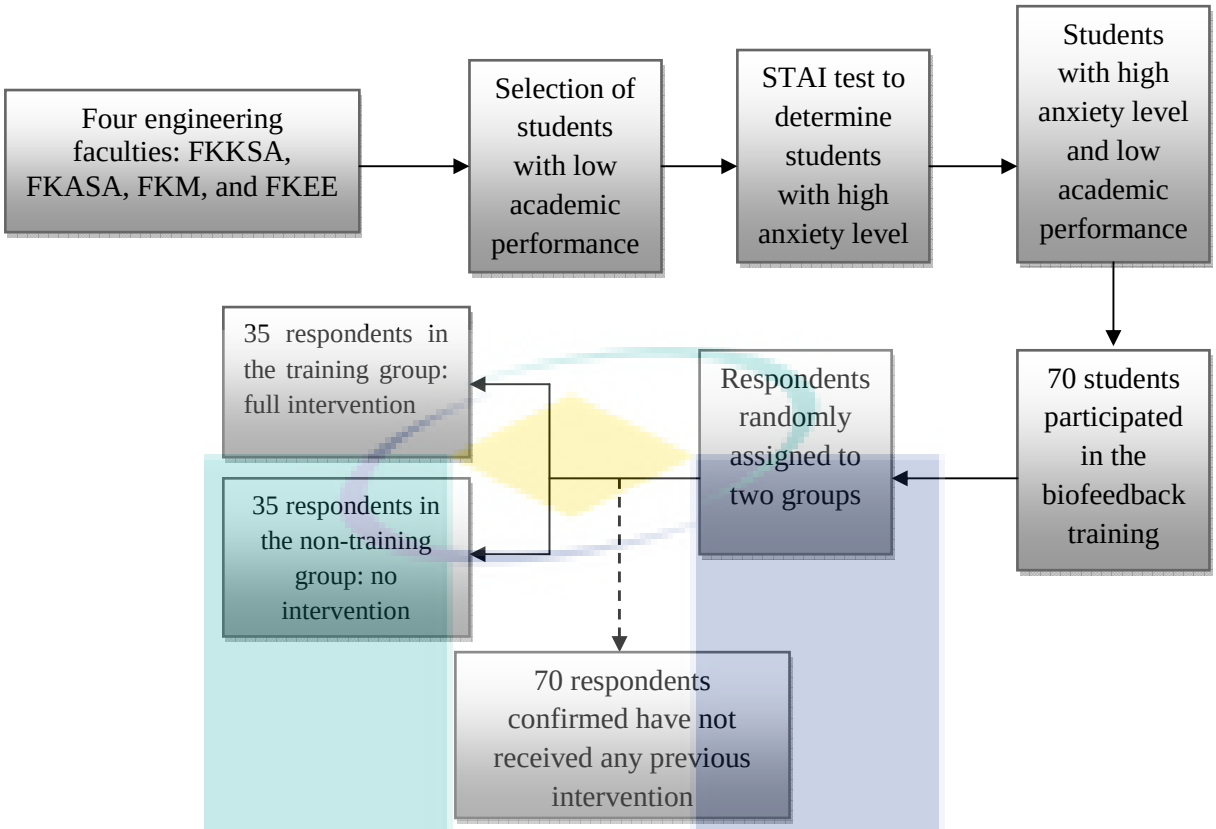


Figure 3.4: Selection of training respondents

b. Training Process

The content of this training is learning to reduce the study anxiety in order to improve students' academic performance. Seventy respondents were randomly assigned into either training group or non-training group. The training group received ten sessions of biofeedback intervention program, one session per week. In opposite, the non-training group attended only the pre and post training. The thirty-five respondents in the training group were divided into four small groups with more less nine respondents in each group. This was done to enable the respondents to focus and learn the techniques of intervention in detail. The training was held on the weekend with the intention not to interfere with learning activities in class. Respondents in the training group must practise the techniques of intervention that they been trained throughout the ten sessions. The training group follow the home schedule to practice the techniques five to ten minutes three-times per day (Schiraldi, 2009) and self study for two hours per-day for every hour of formal lecture. Also, the biofeedback device was used to

measure changes in the heart rate (BPM) and breathing rate (bpm) during each training session.

Biofeedback devices are used to teach and guide the respondents to in practising the protocol to reduce study anxiety by looking at the feedback from their own bodies. They learn the techniques of intervention weekly during the biofeedback training in the laboratory. They were then required to practise these techniques for 5-10 minutes thrice daily in the hostel using only the module guidelines and home exercise schedule. Due to the limited number of the biofeedback devices, the respondents could not bring the device to the hostel. However, they received a simple module to guide them practise the techniques and to monitor the physiological changes in order to control the progress. Each training session's progress was checked with the Stress Sweeper to look for changes of heart beat and respiration. Nevertheless, the physiological assessment was intended as a way to control the respondents while they were practising these techniques. Respondents who practised the techniques performed better than the non practicing ones, while the biofeedback device monitored each progress. This study used self-awareness approach to bring awareness to the respondents in making the daily practice of all techniques that have been taught.

The effect of the biofeedback intervention program can be examined by comparing the significant differences of physiological arousal, cognitive anxiety, and academic performance in the pre post training between training group and non-training group. Measurements were taken in pre and post training for both groups, using the same measuring instrument. The study used seven instruments to evaluate the implementation of biofeedback training among engineering students at Universiti Malaysia Pahang. The instruments include State (STAI form Y-1), Trait (STAI form Y-2), and Study Anxiety Scale (SAS) for measuring cognitive anxiety, the physiological arousal was measured by changes in the heart rate, breathing rate, and Nijmegen score. The GPA which was the final test scores to measure students' academic performance. The process in each session is described below:

i. Session 1

Objective	1. Pre-test 2. To introduce biofeedback training to respondents
Process	70 respondents attend in the pre-test to measure their anxiety level. Then biofeedback device are attached to measure physiological arousal which detected of heart rate and respiration. This session lasted for about two hours (10am-12am). After pre-test, training group receive introduction and explanation regarding objectives of the training. No introduction for non training group.
Learning materials	Introduction and objective of the training. Benefits of the intervention to students.
Instruments	State, Trait, Study Anxiety Scale, Nijmegen, and Stress Sweeper.
Observation	Students excited to learn the new knowledge and attached the biofeedback device

ii. Session 2

Objective	To teach diaphragm breathing to respondents to reduce their anxiety.
Process	Firstly, respondents are asked to recognize their breathing pattern by placing one hand on the chest and another on the diaphragm. The respondents asked to practise the breathing techniques for 15 minutes without using the biofeedback device. Then, each participant is attached with a Stress Sweeper pacer to continue practising the diaphragm breathing. Based on the feedback, the device will indicate to the respondents the type of breathing they are using. In the hostel, students are asked to practise diaphragm breathing for five minutes thrice daily by lying down and putting a thick book on the stomach; the book is used to detect diaphragm breathing.
Learning materials	Diaphragm breathing technique
Instruments	Stress Sweeper to measure heart rate and respiration
Observation	Students cannot perform diaphragm breathing

iii. Session 3

Objective	To produce slow diaphragm breathing by controlling the heart rate
Process	A continuation of the previous session but the respondents needs to attain slow diaphragm breathing in which the exhalation is longer than the inhalation. The respondents used the Stress Sweeper pacer as a guide to produce slow diaphragm breathing. The pacer was designed so that the user can attain as low as six breaths per minute. Finally, the respondents are reminded to

	practise the slow diaphragm breathing for about five to ten minutes three times per-day in their hostel (morning, afternoon and night) and to include in their home exercise schedule (see appendix F). The respondents need regular practice so as to attain slow diaphragm breathing. Figure 3.5 illustrates treatment process of one subject in the training group while practicing the techniques in particularly session.
Learning materials	Slow breathing technique with diaphragm
Instruments	Stress Sweeper pacer used to measure heart and respiration rates.
Observation	Some respondents still use chest breathing due to lack of practice. The pacer is used to measure and check their progress, both in the laboratory and in the hostel.

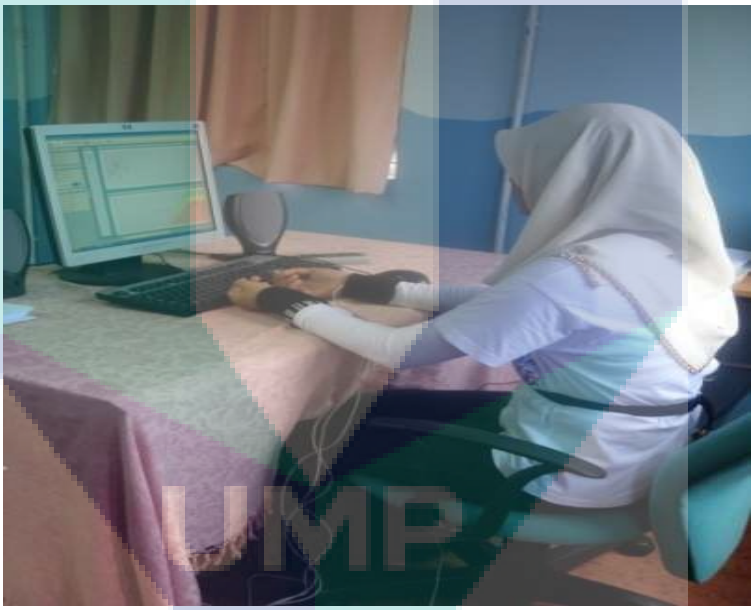


Figure 3.5: Screenshot for student practicing the techniques with the respiration sensor and ECG sensor

iv. Session 4

Objective	To learn relaxation techniques and visual relaxation that aims to increase the sense of relaxation and to improve concentration.
Process	Respondents were asked to relax by following the steps in the intervention. They were asked to close their eyes, imagine that they were in a beautiful place, and try to bring their feelings into a relaxed condition. By focusing on just one picture in the mind can lead to relaxation and improved concentration. This exercise was carried out in five to ten minutes duration after which they a rest and then was repeated till they are really relaxed. After that, they were asked to combine the slow diaphragm breathing, relaxation and visual relaxation to feel more relaxed and calm. The Stress Sweeper pacer is used to their progress at their hostel.
Learning materials	Relaxation techniques, visual relaxation
Instruments	Stress Sweeper to measure heart rate and respiration
Observation	The respondents said that they felt relaxed after the exercises with all three techniques. However, they need a lot of effort to focus during five minute exercise.

v. Session 5

Objective	To learn how to recognize study anxiety sources and how to manage it.
Process	Explanation the study anxiety sources. The respondents were asked to individually recognize and discuss their various sources of study anxiety. Exam anxiety is identified as the major source among the training group. The students claimed that feeling of high anxiety during an examination is due to lack of preparation and last minute study. At the end of the session 5, the respondents were asked to practise the slow diaphragm breathing technique for 15 minutes. The Stress Sweeper pacer was used to check the respondents' progress.
Learning materials	Study anxiety sources, study anxiety symptoms, study anxiety skills (appendix H and I).
Instruments	Stress Sweeper to measure heart rate and respiration.
Observation	Respondents now aware that anxiety affects their academic performance.

vi. Session 6

Objective	To learn resource management skills in enhance self-regulation associated for reducing study anxiety
Process	Teach respondents to enhance their self regulation in term of facing their study anxiety. Discussion and sharing of knowledge between respondents. They learn to recognize problems related to their study. At the end of session 6 was checking their progress in reducing respiration and heart rate.
Learning materials	Resource management skills: effort regulation, peer learning, and help seeking.
Instruments	Stress Sweeper to measure heart rate and respiration
Observation	Average respondents show fine progress in heart rate and respiration. They feel more relax than before.

vii. Session 7

Objective	To learn learning strategy skills and to improve self confidence in study.
Process	Respondents receive 20 minutes of explanation on strategy skills, followed by discussion and reading skills practice. Check progress of their physiological arousal. Discuss effect of breathing and relaxation.
Learning materials	Learning strategy skills: reading skills, note making skills, examination preparation, memory improvement and concentration improvement.
Instruments	Stress Sweeper to measure heart rate and respiration
Observation	Respondents were excited during discussion. Anxiety level significant reduced based on their physiological condition.

viii. Session 8

Objective	To improve study skills
Process	More discussion on academic performance improvement. Tips on how to be successful students given: group studying and a minimum of 2 hours daily review of materials studied on the same day to facilitate in understanding of the subject contents.
Learning materials	Study skills: tips to improve study
Instruments	Stress Sweeper to measure heart rate and respiration
Observation	At some stage in training showed respondents felt motivated to be successful in learning. Some respondents reported improvement in quiz scores.

ix. Session 9

Objective	To teach managing the students' time
Process	Respondents to receive 30 minutes explanation on benefits of time management and guidelines on how to plan the weekly schedule. Then the respondents to create their own weekly schedule. Most of them said that 'I do not have enough time for study, and always study in the last minute'. It is observed that there was no allocation of study time in their weekly schedule. After evaluation of time management, progress of physiological arousal progress checked.
Learning materials	Time management skills: guidelines to create weekly schedule, consultation to manage the time, and design the schedule.
Instruments	Stress sweeper to measure heart rate and respiration
Observation	Students were not disciplined with their time with most of them spending time other than studying.

x. Session 10

Objective	To review skills taught to respondents during earlier sessions. Post test.
Process	After 20 minutes reviewing all the skills taught earlier, respondents evaluate their skills, and prepare for post test. The training group receive post test using the state, trait, SAS, Nijmegen, and physiological assessment. The non training group sat for their post test after the training group. The training was completed one week before the Final Examination.
Learning materials	Review the materials
Instruments	State, trait, SAS, Nijmegen, and Stress sweeper (heart rate and respiration)
Observation	Academic performance was collected after Final Examination.

3.6 INSTRUMENTS

3.6.1 Survey Questionnaire

The questionnaire is used to identify the sources of study anxiety among students (appendix C). The questionnaire was developed based on prior research, observations, and results in terms of anxiety among students. The questionnaires had been checked for reliability and validity. To measure psychological disorders, most of

the questionnaire items use negative characteristics, such as “how often do you feel anxious in an examination due to lack of preparation?” Negative characteristics type questions are also used to measure psychophysiology disorders, such statement as is “I worry too much over something that really doesn’t matter”. Similarly, this can be seen on questionnaire items on stress, anxiety presentation, STAI, anxiety libraries (Laura, 2003; Spielberger, 1980; Anthony et al., 2004; and Stephanie, 2001). For assessing the sources of study anxiety, there are forty items in the questionnaire and for each item there were five scales: one (never), two (almost never), three (undecided), four (fairly often), and five (very often). The questionnaire used likert-scale to assess a person’s feeling about something (Waddington, 2000). After the questionnaires were completed, each item was analyzed and the score can be considered as nominal data; an interval-level data is a measurement where the difference between values is meaningful. Table 3.2 shows the objectives and references of the questionnaire.

Table 3.2: Objectives and reference of questionnaire

Questions	Objectives	References
1. Q1-Q5	To identify exam anxiety	Cassady and Johnson, 2002; Sansgiry et al., 2006; McCraty et al., 2000; Pecararo, 2006, and Greenfield, 1989b.
2. Q6-Q12	To evaluate language anxiety	Horwitz, 2007; Hizwari et al., 2008; Murugesan, 2006; and Ying 2008.
3. Q13-Q17	To estimate mathematics anxiety	Sazhin, 1997, Willcox and Bounova, 2004; Ma and Xu, 2003; and McCraty et al., 2000.
4. Q18-Q24	To identify social anxiety	Purdon et al., 2001; Cowden, 2010; Naomi, 2007; Ryan, 2006, and Cooley, 2007.
5. Q25-Q29	To estimate family anxiety	Susan and Margareth, 2005; Elizabeth, 2003; and Uwaifo, 2008.
6. Q30-Q34	To evaluate presentation anxiety	Murugesan, 2006; Elliot and Joyce, 2005; and Brenda and Tillson (2007) 2007
7. Q35-Q40	To identify library anxiety	Qun and Anthony, 2002, and Cleveland 2001.

This questionnaire was sent to experts for face validation and to improve the questionnaire. The face validity means the validity at face value, as a check of the survey items by sending to the experts to obtain suggestions for modification (Yu, 2005). To test for face validity, three experts related to the area of study are enough for face validity (Ramayah, 2010; Guerrerro, 2007; and Cortés-Martinicorena, 2010). The questionnaire was sent to three experts, who commented on the questionnaire translation and whether it reflected the content and construct of the measurement to identify study anxiety sources. Face validity shown in Table 3.3.

Table 3.3: Face validity

Number	Name of Experts	Comments
1	Prof Dr Ahmad Bin Othman (expert in management training and vocational education, Universiti Malaysia Pahang)	Improve the content; the instrument is valid for data collection.
2	Assoc Prof Dr Abdullah Bin Ibrahim (expert in vocational education studies, Universiti Malaysia Pahang)	Correction in the questions and content; the instrument is suitable for the survey
3.	Dr Mohd Ghani Bin Awang (expert in education counselling, Universiti Malaysia Pahang)	Design the instrument and its content; improve language, The instrument considered to identify study anxiety sources

3.6.2 Instruments to Asses Physiological Arousal

The physiological arousal instruments aimed to examine the effect of biofeedback intervention program to reduce anxiety in term of physiological arousal. These instruments are including heart rate (BPM), breathing rate (bpm), and Nijmegen questionnaire. For physiological measurement, this study used a biofeedback tool called the Stress Sweeper Biocom 3000 series. Stress Sweeper is a powerful and scientifically valid breathing training tool that offers reliability and flexibility to the clinician and researcher (Pougatchev and Pougatchev, 2008). The Stress Sweeper has two sensors are

Electrocardiograph (ECG) and respiration. The device used was to stimulate the baroreflex mechanism and to balance the activation of parasympathetic nervous system and sympathetic nervous system (Pougatchev and Pougatchev, 2008). The aim of the balance is to help students in reducing the effect of anxiety in academic performance. Deep and pace breathing was used to stimulate baroreceptors and stimulus a response of parasympathetic nervous system resulting in heart rate oscillations synchronous with breath cycle. The device was a portable device connected to PC via standard USB port, and is shown in Figure 3.6.

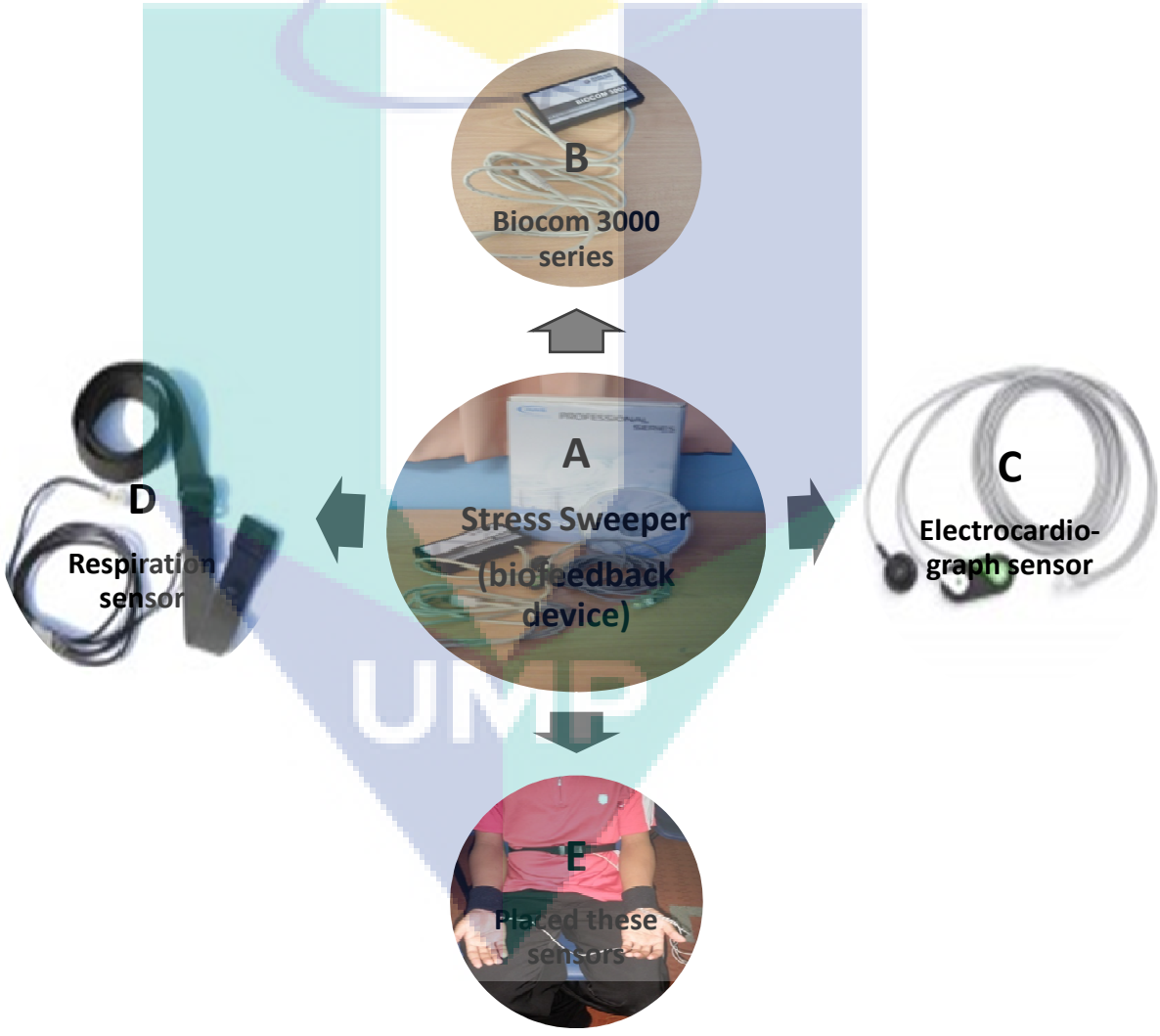


Figure 3.6: Stress Sweeper Biocom 3000

Description:

A: Stress Sweeper is a biofeedback device.

B: The Biocom 3000 with two sensors, ECG sensor and respiratory sensor.
C: ECG sensor to assess heart rate with unit of measure beat per-minute/BPM (placed on the hand).
D:Respiratory sensor to assess breathing rate with unit of measure breath per-minute/bpm (placed on the abdomen/diaphragm).
E: Application of the device.

In the training, Stress Sweeper uses the breath cycle pattern of a user as a tool to trigger, generate and maintain respiratory sinus arrhythmia (RSA) waves. The respondents are presented with a specific breath cycle pattern as a pacer that they must follow during training. Each training session begins with a data accumulation phase when physiological data is accumulated for proper calculations. The goal of the training sessions was to achieve high amplitude respiratory sinus arrhythmia (RSA) waves and to maintain it throughout the entire session. The apparatus provides waves display signals, provides feedback, collects data, prints reports, and exports database compatible files. The signal is transformed into information and then is displayed on the computer screen as follows.

a. Heart Rate

Heart rate measures beat per-minute (BPM) with placed the electrocardiograph (ECG) sensor and recorded for five minutes with the accumulated time of one minute (Pougatchev and Pougatchev, 2008). The training expected for average of heart rate is around 70 beats per minute. To found the expectation result, the respondents were instructed to practise breathing exercises, relaxation, and visual relaxation to produce that rate. Using the Biocom 3000 ECG recorder, a single electrode pad was placed on the right wrist and a dual electrode pad on the left wrist, with the electrode disks facing down. Both electrode pads are firmly secured to the wrists with the wristbands.

b. Breathing Rate

Breathing rate measures breathe per-minute (bpm) with placed the respiratory sensor in the diaphragm. The breathing rate was calculated by recording the breathing

for five minutes with the accumulated time of one minute (Pougatchev and Pougatchev, 2008). Respiration is a physiological phenomenon and used as the basis for the training techniques in this study. The device is used to guide the respondents to achieve slow breathing via the biofeedback loop, and attaining slow breathing is essential for the successful outcome of the training (Pougatchev and Pougatchev, 2008). The pacer has been set for six breaths per-minute. Figure 3.7 display the pacer.

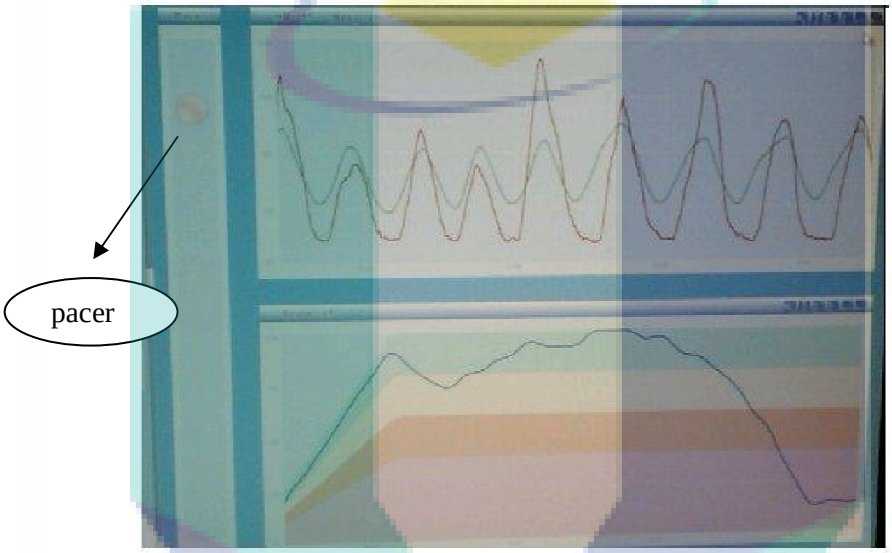


Figure 3.7: Display of the pacer

In the breathing exercises respondents were instructed to breathe slowly through diaphragm breathing. Respiration target is 6 breath/min. The Biocom 3000 Stress Sweeper series was designed with the pacer to guide slow breathing exercise. The respiration sensor was placed around diaphragm/abdominal with the sensor box located near the diaphragm. The length of sensor strap was adjusted for the extensible part of the rests on the body.

Moreover, the training target is indicator of both slow breathing and slow heart rate, reflecting the student's capacity to reduce physiological arousal (Lehrer and Woolfolk, 2007; and Pierini, 2010). Figure 3.8 illustrate the screenshot on the computer screen presented of breathing rate, hear rate, and training target as follow.

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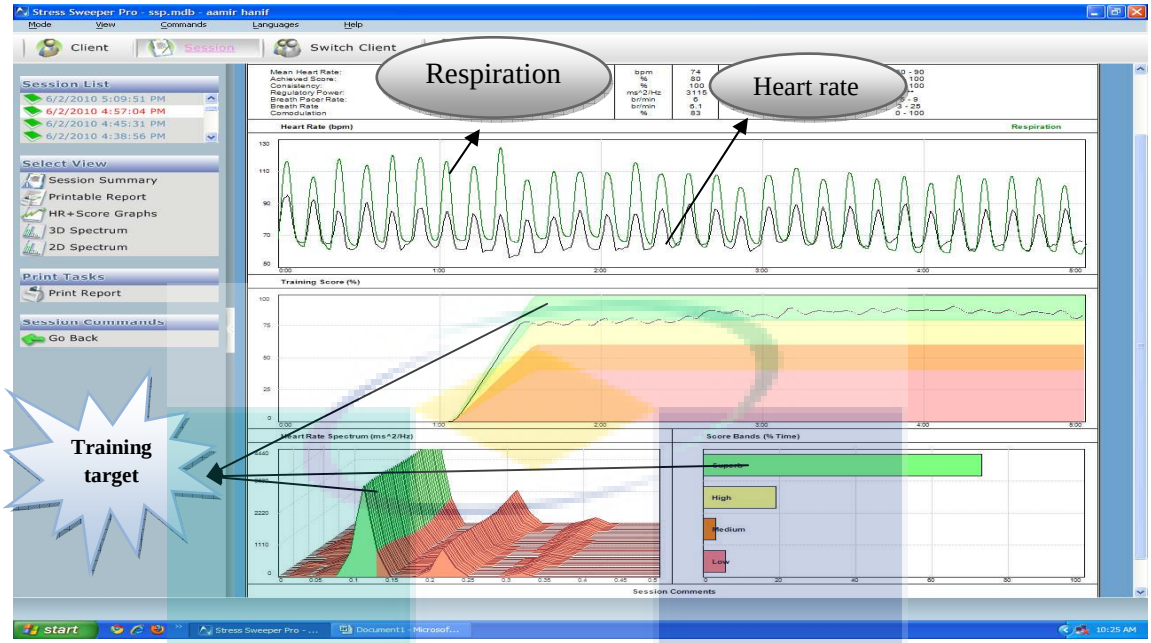


Figure 3.8: Screenshot on the computer screen

c. Nijmegen Questionnaire

The Nijmegen Questionnaire is designed to measure physiological arousal through hyperventilation, which could be an indication of high anxiety (appendix H). The sensitivity of the Nijmegen Questionnaire in relation to the clinical diagnosis is 91% and the specificity is 95%. It is concluded that the questionnaire is suitable as a screening instrument for early detection of hyperventilation syndrome (HVS), and also as an aid in diagnosis and therapy planning (Van Dixhoon and Duivenvoorden, 1985). Another opinion suggests using this instrument to treat dysfunctional breathing with a quick, easy-to-administer and low-impact assessment tool (Thomas et al., 2003; and Humphriss et al., 2004). For this training, the instrument was obtained by downloading from an online source.

There are sixteen questions related to abnormal respiratory symptoms that are placed on five scales: zero (never), one (seldom), two (sometimes), three (often), and four (very often). Healthy respondents with Nijmegen score > 23 were involved in this study. Nijmegen scores were calculated from the total scale. High Nijmegen score

indicate the presence of abnormal breathing and a variety of mental symptoms based on breathing patterns (Van Dixhoorn and Duivenvoorden, 1985). The questionnaire was validated for consistency, reliability and test validity. The interpretation of Nijmegen score is determined in Table 3.4 below.

Table 3.4: The interpretation of Nijmegen score

Nijmegen score	Interpretation
Nijmegen < 23	Low
Nijmegen > 23	High

3.6.3 Instrument to Measure Cognitive Anxiety

The cognitive anxiety instruments are to examine the effect of biofeedback intervention program in reducing cognitive anxiety. These instruments including STAI (state and trait), the study anxiety scale (SAS), and the instruments are described below.

a. State Trait Anxiety Inventory (STAI Form Y)

State Trait anxiety Inventory (STAI) is an instrument to measure anxiety designed by Spielberger et al. (1993). The STAI has been used extensively in research and clinical practice for high school, college students, and adult (Spielberger et al., 1993). The instrument used to measure cognitive anxiety with two components, state and trait, in which state is right now or at this moment feeling about anxiety, and trait is general feeling about anxiety. The STAI has been selected for this study with a reason that the instrument is establish, sensitive, useful, suitable, accurate, and reliable in detecting anxiety changes (Spielberger, 1983; and Qeuk et al., 2004). Moreover, Spielberger (1983) mention that the content of the replacement items, which was consistent with theoretical of anxiety. Many college students contribute to build reliability and validation of the STAI, that were designed based on scientific and methodological contribution to the field of psychological assessment and personality research (Spielberger, 1983).

The instrument was purchased from Mind Garden Company in the United States of America. This instrument used all original items with no modification whatsoever. The State-Anxiety scale (STAI Form Y-1, see appendix E) consists of twenty statements that evaluate how respondents' feel about anxiety "right now, at this moment". The Trait-anxiety scale (STAI Form Y-2, see appendix F) consists of twenty statements that assess how people "generally feel" about anxiety. Both of these on four scale: one (not at all), two (somewhat), three (moderately so), and four (very much so). A rating of four indicates the presence of a high level anxiety and one indicates the absence of a high level anxiety (Spielberger, 1983). The anxiety level was found by calculation of scores, scores both of the S-anxiety and T-anxiety scales which can vary from a minimum of 20 to a minimum of 80. The level of STAI score was determined in Table 3.5 as follows:

Table 3.5: The interpretation of State and Trait score

State score	Trait score	STAI score	Interpretation
State < 40	Trait < 40	STAI < 80	Low
State > 40	Trait > 40	STAI > 80	High

Source: Spielberger et al. (1993)

STAI instrument was consistent for both of reliability and validity (Spielberger, 1983). Since 1990–2000's, researchers used the STAI for measuring anxiety level including anxiety test among students. The STAI has been established for its' reliability and validity. However, the study instrument used in this study was also tested for reliability and validity. Table 3.6 presents the comparison of reliability and validity tests for STAI.

Table 3.6: The comparison of reliability and validity for STAI

Instrument	Number of items	Items deleted	Cronbach Alpha
Original instrument			
State	20	-	.84
Trait	20	-	.76
The study instrument			
State	20	-	.76
Trait	20	-	.85

b. Study Anxiety Scale

Study of Anxiety Scale (SAS) was developed based on hundreds anxiety symptoms associated with anxiety (Anxiety Centre.com, 2008; and Spielberger, 1980). This instrument was designed to evaluate the anxiety level, to provide an overview of symptoms of anxiety and the intensity at a particular point of study anxiety (see appendix G). This test takes about 10 minutes to complete. SAS has twenty items with five scales: one (no), two (somewhat), three (being so), four (a lot), and five (very much). A scale of five indicates of high score. Scoring of SAS was calculated from the total scores. This instrument was consistent for reliability (Cronbach's Alpha score of .89) and validity test. The interpretation of SAS score is shown in Table 3.7 below.

Table 3.7: The interpretation of Study Anxiety Scale

SAS score	Interpretation
SAS < 23	Low
SAS > 23	High

3.6.4 Grade Point Average (GPA)

Grade Point Average (GPA) is a measure of the academic performance of students. The GPA is the best prediction of academic performance (Sansgiry et al., 2006). Academic performance is an observable and measurable behaviour of student at

any point in time during a course. The GPA is obtained from final examination scores (Yusuf, 2002). GPA is calculated by equivalent of the grade for all courses divided by the total credit hours registered in the semester (Sansgiry et al., 2006).

The respondents' academic performance measured was in the form of their latest grade point average (GPA). Initially, the low GPA adopted as the standard for the study was in accordance with the UMP grading system which is GPA < 2.00. However, there were not enough of respondents in that category of low academic performance in UMP. Then a decision was made to follow the grading systems of the public universities in Malaysia. As a result, the new categorizing of academic performance was GPA < 2.50 for low academic performance and GPA > 2.50 for high academic performance. This research compared students' GPA in the second semester and third semester to examine effect of the intervention towards academic performance in the pre post training.

3.6.5 Self-evaluation

Self-evaluation aimed to evaluate the respondents feeling, experiences, and thought regarding the effect of biofeedback intervention program to reduce anxiety in the improvement of academic performance. This evaluation reiterates that open ended question can be blended in order to strengthen an investigation. The advantages of the open-ended questions include the possibility of discovering the responses that individuals give spontaneously, and thus avoiding the bias that may result from suggesting responses to individuals, a bias which may occur in the case of close-ended questions (Reja et al., 2003). The open-ended question, of this research was to gather information from respondents in the training group whose responses could not be accurately predicted categorically. The component consisted of self-evaluation which focused on overcoming the problems encountered during their study (appendix J), identifying their study anxiety sources (appendix B), determining their feeling about physiological arousal (appendix J), their feeling on how to terminate cognitive anxiety (appendix B), and evaluating their academic performance (appendix J). Self evaluation form begins from open-format data and applies a systematic qualitative procedure to convert into nominal data that can be used for further quantitative analyses.

3.7 DATA COLLECTION

The present study has two methods of data collection: the survey for identification of study anxiety sources, and the biofeedback training to examine the effect of study anxiety intervention. The methods are described as follows.

3.7.1 Survey

The survey was conducted to identify the sources of study anxiety among students. The quantitative data collection was focused on collecting numeric data from all respondents to identify the significant sources of study anxiety that influence academic performance. The survey used closed ended question to engage the feelings, thoughts and experiences of study anxiety. The data were collected by the researcher over a 4-weeks period during the second semester. Respondents were informed of detailed directions for completing the survey. The directions include the aim of the survey, how to answer the questions, translate the difficult terms, and assist them to complete the questionnaire.

3.7.2 Anxiety Test

Respondents administered the STAI to determine their anxiety level. Qeuk et al. (2004) has been validating the English version of the Spielberger State-Trait Anxiety Inventory (STAI) in a sample of Malaysia patients. A total of 237 respondents had total mean STAI score of 82.43 (*SD* = 11.55). Higher STAI scores reflect higher levels of anxiety. Finding of test-retest correlation coefficients for the 40 items score show highly significant (ICC = .39 to .89). In addition, to determine the study anxiety level used combine of State and Trait scores. The statement confirmed by Spielberger who was designed the instrument that was suggested using a combination of State and Trait scores to determine how anxiety influences academic performance (appendix S). In addition, the test aimed to select training respondents.

3.7.3 Biofeedback Training

The main of data collection was biofeedback training. Biofeedback training is an educational process for individuals to learn specialized mind/body skills to recognize how their bodies are functioning and to control patterns of physiological functioning, for the purpose of reducing study anxiety to improve academic performance (Stephen, 2001; and Arguelles et al., 2003). Stephen (2001) cited that biofeedback training is an effective approach to cope with psychophysiology disturbances. Some studies also reported significantly reduced anxiety levels among students after using biofeedback (McCrathy, 2000; Dennis, 1977; and Christopher, 2006). The biofeedback training is a set of intervention techniques, skills, and equipment to reduce study anxiety for improving academic performance.

The 70 respondents divide into two groups including 35 respondents in the training group that received full intervention and another 32 respondents for the non-training group with no intervention. The training group received the intervention in 10-sessions during the third semester. Pre post tests were administered to examine the effect of biofeedback intervention program to reduce anxiety in the improvement of academic performance.

3.8 DATA ANALYSIS

The data was collected from four sources including survey, anxiety test, biofeedback training, and self-evaluation. These were analyzed use quantitative method. All data was tested for normality before analysis, the normal data distribution employed parametric and non-normal data distribution used non-parametric. The data was calculated from post to pre to find significant changes in the effect of the biofeedback intervention program in reducing anxiety to improve academic performance. The statistical analysis runs on SPSS 16.00 statistical software. Significant level for all tests used $p < .05$. Explanation of data analysis through instruments used as a data collection was give details as follows:

3.8.1 Data analysis of survey

The survey data aimed to examine research objective one which is to identify significant sources of study anxiety among university students. One sample t-test (*t-value*) was used to find out significant sources of study anxiety. Instrument that was used survey questionnaire.

3.8.2 Data analysis of anxiety test

The analysis aimed to assess research objective two which is to find significant relationship between anxiety and academic performance. Pearson correlation was used to find out significant correlation of anxiety and academic performance. Instruments that were used including STAI and GPA.

3.8.3 Data analysis of biofeedback intervention program

The analysis aimed to assess research objective three and four which is to develop intervention module for reducing study anxiety in order to improve academic performance and to examine the effect of biofeedback intervention training for the improvement of academic performance among engineering students at UMP. The analysis as follows:

a. Repeated measure ANOVA (*f-value*) to examine of time changes in beat per-minute (BPM) and breathe per-minute (bpm) among training group. The instruments calculate the heart rate (BPM) and breathing rate (bpm).
b. Paired samples t-test (*t-value*) to find out significant differences in pre post training between groups. Instruments that were used include heart rate, respiration, and Nijmegen for physiological. In addition to determine of cognitive used State and SAS. For academic performance measures by GPA.
c. Wilcoxon signed-rank test (*z-value*) as a non-parametric version for Paired samples t-test was used to find out significant differences in pre post training between groups for Trait scores.
d. Multiple linear regression to assess the Catastrophe model in the effect of intervention in order to determine a significant correlation between changes in

anxiety to academic performance. Instruments that were used include beat per-minute to determine physiological arousal, State to verify cognitive anxiety, and GPA to assess academic performance

In addition, data analysis also requires to find out the value of effect size, according to Field (2005) mentioned that the effect size is to estimate the power of tests that have been achieved. Among many proposed measurements for size effect, the most common is the Pearson correlation coefficient *r* because it is restricted to lie between 0 (not applicable) and 1 (perfect effect) (Filed, 2005). A widely accepted suggestion on what constitutes a large to small effect is presented in Table 3.8 below.

Table 3.8: The interpretation of effect size

Effect size	Category	Description
0.10	Small effect	The effect explains 1% of the total variance
0.30	Medium effect	The effect accounts for 9% of the total variance
0.50	Large effect	The effect accounts for 25% of the variance

Source: Field (2005)

3.8.4 Data analysis of self-evaluation

The analysis aimed to assess research objective four which is to examine the effect of biofeedback intervention training for the improvement of academic performance among engineering students at UMP. This research proposed a procedure for transforming data into quantitative results. Converting raw, open-ended data from the main category into the sub-categories that the research can be used to convert and quantify data from open-ended questions into quantitative statistics. Data were analyzed by calculating the summation of units in each sub-category to find out the frequency and percentage. Coding turn data (texts) into quantitative data (codes) and these codes can be just with subjective codes in the answers (Srnka and Koeszegi, 2007). Throughout the entire process, this step by step operation was documented in separate files

(appendix A, D, and I). The process continued until coders had verified that each main category could be assigned to each sub categories. After the main category coding was run, for the assigning of sub-categories were eliminated into units and code such as "physiological arousal (main category) – reduce breathing rate (sub category) – be able to slow breathing with diaphragm (unit) – 1 (code)". A general objective was finally formulated based on the main categories. Table 3.9 describes the main category.

Table 3.9: The main category

Main category	Objective
1. Pre-training evaluation	To identify the students' problem which cause low academic performance
2. Study anxiety sources	To identify the study anxiety sources such as examination, presentation, social, family, library, language, and mathematic
3. Physiological arousal	To determining their feeling about physiological arousal such as diaphragm breathing and relaxed feeling
4. Cognitive anxiety	To terminate their feelings of cognitive anxiety by reducing anxiety level and improving self confident
5. Academic performance	To evaluate their academic performance such as improved study skill and better GPA

The final scheme displayed comprises of five main categories, each of which contains up to three subcategories, resulting in a total of 21 categories. Based on this scheme, concluded the final main coding run where each coding unit was assigned a main and a subcategory code as shown in the example in Table 3.10.

Table 3.10: Assigning main category and subcategory to units and code

Main category	Subcategory	Units	Code
1. Pre training evaluation	Poor study skills	Lack of concentration, difficult in understanding of subject, lack interest of subject, and lack of motivation	1
	Lack of preparation	Last minute study and lazy	2
	Other problems	Financial problem, and lack of confidence.	3

2. Study anxiety sources	Exam	Lack of preparation	1
	Social	Problem with peers, lack of confidence	2
	Presentation	Lack of confidence	3
	Mathematics	Lack of interest	4
	Language	Lack of confidence	5
	Family	Financial problem	6
	Library	-	7
3. Physiological arousal	Reduce breathing rate	Be able to breathe with diaphragm and slow breathing improve respiration skills	1
	Feel relax	Relax, comfortable, calm	2
	Improve physical health	Reduce headache, dizziness, physical well being, reduce heart beat.	3
4. Cognitive anxiety	Reduce anxiety level	Improve confidence, release nervousness, release tension	1
	Release negative feeling	Be able to control emotions, reduce sleep disorders, release stress	2
	Improve positive feeling	Feel happy, think positive, calm, self motivation	3
5. Academic performance	Increase academic performance	Higher GPA	1
	Decrease academic performance	Lower GPA	2
	Improve study skills	Be able to handle tasks, improve concentration, comfortable to study	3
	Improve time management	Be able to allocate the time to study	4
	Other progress	Reduce presentation anxiety, increase test score, reduce sleepiness during class, more confidence	5

3.9. Restatement of Hypothesis:

Hypothesis 1

Hypothesis one predicted that the seven sources will show significant created anxiety among university students. Previous studies have found seven potential sources of study anxiety among university students. A survey was conducted among UMP students to identify the sources of the anxiety. One sample t-test was used to find out the significant sources of study anxiety.

Hypothesis 2

Hypothesis two predicted that there will be significant correlation between study anxiety and academic performance among university students. A correlation analysis was used to evaluate the significant correlation of anxiety upon academic performance. The anxiety was measured by STAI and the academic performance based on GPA. Pearson's correlation measures to find out significant correlation of study anxiety and academic performance.

Hypothesis 3

Hypothesis three predicted that Students in the training group will show significant changes of physiological arousal. The physiological assessment among the training group was carried out to determine whether physiological arousal has a significant improvement during the ten training sessions. Repeated measure ANOVA to find out significant of time differences on physiological arousals among the training groups. Heart rate (beats per minute) and respiration (breaths per minute) were collected during the 1st session (pre-training), 4th session, 7th session, and 10th session/post- training (Lehrer and Woolfolk, 2007). Effect size was calculated to examine the implementation of intervention effects among the training group.

Hypothesis 4

Hypothesis four predicted that Students who learned the intervention for ten sessions will show significant reduced a physiological arousal from pre to post than students who have not learned. To evaluate the effect of intervention on physiological arousal, Paired samples t-test was used to assess whether significant differences of pre

post training between the training group and the non-training group. Physiological arousal is indicated by the differences in the heart rate, respiratory rate, and Nijmegen score between the two groups. To examine the implementation of intervention training effect size was used to compare between groups.

Hypothesis five

Hypothesis five predicted that Students who received the intervention for ten sessions will show significant decreased of cognitive anxiety from pre to post than students who have not received. To examine the effect of intervention on cognitive anxiety level, Paired samples t-test and Wilcoxon signed-rank test were used to assess whether any significant differences of pre post training between the training group and the non-training group. Cognitive anxiety level was measured by State, Trait, and SAS to look at the differences of pre post training in terms of level of anxiety. Effect size was calculated to examine the implementation of intervention training between groups.

Hypothesis six

Hypothesis six predicted that Students who learned the intervention for ten sessions will show a higher GPA increase than students who have not learned. Paired samples t-test was used to examine the effect of intervention on academic performance, looking for a significant difference of pre post training between the training group and the non- training group. Academic performance was measured by GPA which was collected from the respondents' final examination. Effect size was calculated to examine the implementation of intervention training between groups.

Hypothesis seven

Hypothesis seven predicted that there will be significant correlation between changes of anxiety to academic performance. Multiple linear regressions used to examine the Catastrophe model in the effect of biofeedback intervention program in order to determine a significant correlation between changes in anxiety to academic performance. Whether if physiological arousal is low, cognitive anxiety has a positive relationship with performance and when cognitive anxiety is high, it will increase the level of physiological arousal to drop performance.

3.10 PILOT STUDY

The pilot study was conducted to test the reliability and validity of those instruments in this study. Furthermore, the pilot study was tested the intervention through preliminary training and sending the intervention to expertise who relate with this study. The face validity aimed to view in improving of the intervention.

3.10.1 Reliability and Validity Test of Research's Instruments

This study is to report on the reliability and validity of instruments used among engineering students. The instruments was used as an evaluation tool in this study and consisted of five instruments. A total of 20 students from 4 engineering faculties randomly selected to test for reliability and validity of the instruments. Reliability for each instrument was estimated as item to total score correlation and internal consistency (Cronbach's alpha). Construct validity was determined through factor analysis. Nunnally (1978) recommends that the instruments used in basic research must have a reliability of Cronbach Alpha score .70 or better. Factor Analysis was completed to determine construct validity by using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. That was applied to appraise the appropriateness of the factors extracted. According to Sekaran (2005) and Field (2005), the sample and factors extracted was considered as adequate and appropriate if KMO value should be above than .5 and Bartlett's test was significant (*p-value* < .05).

a. Reliability and Validity for Survey Questionnaire

The objective of the survey questionnaire is to identify sources of anxiety since by knowing them it will be easier to further conduct treatments to reduce the anxiety level of students and improve their academic performance. The questionnaire confirmed the reliability score with Cronbach's alpha yielded 0.93. For validity test shows that the questionnaire valid as an instrument, KMO values for individual sources of anxiety was produced of the anti-image correlation matrix more than .5 for all sources (exam, .729; language, .793; mathematics, .759; social, .792; family, .779; and library. 826), Bartlett's test was significant with p =.000. In addition, the reliability and validity test

confirmed above the bare minimum of requirement scores consequently no removable of the questionnaires' items and components. Table 3.11 presented the result.

Table 3.11: Reliability and validity of survey questionnaire

Number of items	Items deleted	Cronbach Alpha	KMO score	Bartlett's test
40	-	.93	> .5 for all sources	.000*

Note: *significant if p < .05

For each item was tested using factor analysis to find rotated pattern matrix. According to Field (2005) the pattern matrix contains the loading of each question into each component. The pattern matrix of those data represents for number of questions and components, the components appear of seven sources for study anxiety. Component 1 seems to represent social anxiety, component 2 represents exam anxiety, component 3 represents presentation anxiety, component 4 represents library anxiety, component 5 represents language anxiety, component 6 represents family anxiety, and component 7 represents mathematics anxiety. Sekaran (2005) suggested that suppressing loading more than .3 represent substantive value. Table 3.12 presents the loading scores were above .3 for all components.

Table 3.12: Factor analysis of survey questionnaire

Number of Questions	Components							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**Communa-lity**
E1	3.527E-6	**.602**	.148	-.031	-.004	.081	.061	.396
E2	.065	**.588**	.048	.047	.050	.059	.132	.378
E3	.048	**.552**	.028	.183	.118	.090	.166	.391
E4	-.026	**.660**	.070	.066	-.075	.002	.083	.458
E5	.093	**.625**	.110	.057	.079	.044	.089	.431
E6	.107	**.591**	.172	.018	.176	-.093	.055	.433
E7	.003	**.557**	.161	-.028	.197	-.062	.051	.382
L1	.130	.229	-.007	.073	**.686**	.043	-.003	.547
L2	.016	.217	.391	.073	**.624**	-.087	-.029	.603
L3	.015	.033	.245	.169	**.546**	.085	.130	.412
L4	.100	.092	.192	.134	**.495**	.206	.093	.370
L5	.042	.093	.519	.051	**.494**	.010	.089	.534
M1	.049	.223	.052	.100	.053	.009	**.750**	.631
M2	.021	.295	.092	.017	.148	.063	**.422**	.300
M3	.107	.262	.075	-.009	.024	.053	**.322**	.104
M4	.027	.305	.086	-.043	-.005	.048	**.658**	.538
M5	.232	.086	.011	.163	.047	.054	**.667**	.538
S1	**.483**	.074	.067	.035	.175	.084	.265	.353
S2	**.653**	-.004	.117	.147	-.086	.099	.027	.479
S3	**.617**	.045	.107	.126	.038	.115	.110	.437
S4	**.646**	.148	.002	.100	.087	-.038	.037	.459
S5	**.725**	-.013	.067	.121	.013	.092	-.006	.553
S6	**.607**	.105	-.038	.207	.178	.130	-.006	.472
S7	**.485**	.107	.198	.115	-.027	.212	.044	.346
F1	.313	-.011	-.061	.195	.250	**.359**	.076	.336
F2	.340	-.051	-.014	.141	.330	**.366**	.111	.394
F3	.201	-.079	-.003	.202	.229	**.625**	-.004	.530
F4	.123	.217	.179	.075	-.040	**.691**	-.011	.579
F5	.134	.054	.029	.110	-.022	**.759**	.131	.627
P1	.062	.188	**.775**	.060	.101	.079	.119	.674
P2	.124	.181	**.784**	.069	.138	.043	.057	.691
P3	.129	.231	**.775**	.032	.080	.002	.054	.681
P4	.087	.175	**.662**	.141	.173	.086	.008	.533
P5	.242	.107	**.249**	.254	.117	.258	-.109	.289
LI1	.077	.001	.058	**.500**	.215	.266	.137	.395
LI2	.231	.051	.005	**.661**	.032	.151	.004	.517
LI3	.099	.098	.156	**.671**	-.038	.101	.110	.518
LI4	.117	.007	.046	**.724**	.156	.030	.060	.570
LI5	.101	.013	.036	**.741**	.109	-.004	-.003	.573
LI6	.243	.081	.061	**.631**	.049	.100	.008	.479
Eigenvalue	8.131	8.040	7.755	7.706	5.612	5.272	4.815	
%variance	8.131	16.171	23.926	31.631	37.244	42.516	47.331	

b. Reliability and validity for STAI, SAS, and Nijmegen

The instruments confirmed the reliability score with Cronbach's alpha above than .7 of all instruments (state, .765; trait, .857; SAS, .900; and Nijmegen, .876). For validity test shows that those instruments valid with KMO values shows more than .5 for all instruments (state, .512; trait, .694; SAS, .719; and Nijmegen, 707), Bartlett's test was significant for all instruments with p =.000 respectively. The reliability and validity test confirmed above the bare minimum of requirement scores subsequently no removable of the instruments. Table 3.13 presented the results as follows.

Table 3.13: Reliability and validity test of instruments

Instruments	Number of items	Items deleted	KMO score	Bartletts test	Cronbach Alpha
State	20	-	.512	.000*	.765
Trait	20	-	.694	.000*	.857
SAS	20	-	.719	.000*	.900
Nijmegen	16	-	.707	.000*	.876

Note. *significant if p < .05

3.10.2 Pilot study to assess The Effect of Biofeedback Intervention Program

This intervention has been sent to experts to find the face validity for improving the intervention. The face validity means the validity at face value, as a check of the intervention by sending to the experts to obtain suggestions for modification (Yu, 2005). To test for face validity, three experts related to the area of study are enough for face validity (Ramayah, 2010; Guerrerro, 2007; and Cortés-Martinicorena, 2010). The intervention was sent to three experts, who commented on the intervention translation and whether it reflected the content and construct of reducing anxiety for students. Face validity is as shown in Table 3.14.

Table 3.14: Face validity

Number	Name of Experts	Comments
1	Prof Dr Ahmad Bin Othman (expert in training management and vocational education, Universiti Malaysia Pahang)	No improvement needed; the intervention has been completed with significant results.
2	Assoc Prof Dr Abdullah Bin Ibrahim (expert in vocational education studies, Universiti Malaysia Pahang)	No improvement required; the intervention has been completed with significant results
3	Davide Pierini Keiron (Expert in psychophysiology, neurofeedback, and biofeedback studies at Biofeedback Foundation of Europe/BFE)	The module was enough to reduce anxiety. May conduct follow up activities to treat respondents whose heartbeats are still high (through Biofeedback Online course, 2010)
4	Dr Annette Deyhle (expert in biofeedback and anxiety studies at Institute of HeartMath)	She said "I looked through your anxiety program, and I think it done well" (appendix K)

The preliminary training was conducted with twelve students to test the intervention before collecting the data. The results showed a significant difference of pre and post tests for trait, SAS, Nijmegen, beat per minute, and breathe per minute among the training group. The training saw a reduction of study anxiety and improvement of academic performance in the training group compared to the non training group. The results are shown in Table 3.15.

Table 3.15: Results of preliminary training

Measures	Groups	M	SD	t	Sign (p)
State	Training	43.17-33.67	10.226-6.088	2.465	.057*
	Non-training	46.17-40.83	11.232-6.969	1.835	.126**
Trait	Training	47.17-21.33	11.279-11.325	4.433	.007*
	Non-training	43.67-24.67	8.641-12.675	3.380	.020*
SAS	Training	25.33-10.83	7.967-7.834	5.863	.002*
	Non-training	22.33-18-83	18.522-12.813	.681	.526**
Nijmegen	Training	20.33-6.17	10.820-5.913	3.905	.011*
	Non-training	20.17-17.17	7.731-13.152	2.207	.078**
GPA	Training	2.28-2.76	.446-.456	-2.508	.054**
	Non-training	2.561-2.28	.855-.781	-1.135	.308**
BPM	Training	85.67-71.33	9.606-10.405	3.549	.016*
	Non-training	89.67-82.33	6.890-6.324	2.803	.038*
bpm	Training	17.97-6.33	6.073-1.211	5.456	.003*
	Non-training	15.87-10.83	4.513-7.473	4.118	.009*

Note. M=mean pre-post, SD=standard deviation, *significant if $p < .05$,
**not significant if $p > .05$

The pilot study was conducted in six sessions during the short semester. The results show improvements in the training group and found significant difference in pre post training when compared to that of the non training group. However, six sessions was not enough to deliver the materials and the students did not have sufficient time to apply the techniques. Based on this experience, the biofeedback training must be conducted in more than six sessions to attain the effect of the intervention for students' academic performance (K-State, 2007 and Schiraldi, 2009).

3.11 SUMMARY

This chapter has presented an explanation of the methodology employed in this study, which includes research framework, research design, sample selection, research process, data analysis, and pilot study. The pilot study was conducted before data collection. The results of pilot study showed that the instruments were proven to be reliable and valid. Validity of the intervention showed that study anxiety intervention with biofeedback training was sufficient to be use as an intervention program for the students. The results are presented in the next chapter.

CHAPTER 4

RESULTS

4.1 INTRODUCTION

This chapter presents demographic information, normality test of data, verification of intervention effects, self evaluation finding, and summary. The main goal was to assess the effect of biofeedback intervention program in reducing anxiety to improve academic performance. The effect was investigated based on physiological assessment, cognitive anxiety level, and academic performance.

4.2 DEMOGRAPHIC INFORMATION

Descriptive analysis was carried out in order to understand the profile of the respondents, such as gender, faculty, age, health problems, problems related with their study, and grade point average.

4.2.1 Survey Respondents

A total of 905 Universiti Malaysia Pahang first year engineering students were selected for a survey conducted in February 2008. The original sample comprised 770 respondents taken from four engineering faculties. Absent students were not included in the sample. The respondents consisted of 395 males and 375 females. The respondents were the students who voluntarily participated in the survey. Demographic of respondents is shown Table 4.1.

Table 4.1: Demographic of survey respondents

Demographic info	Frequency	Percentage
1. Gender		
Male	395	51.30
Female	375	48.70
2. Faculty		
FKKSA	214	27.80
FKEE	201	26.10
FKM	159	20.65
FKASA	196	25.45

4.2.2 Respondents for Correlation Test

A total 205 students with low academic performance from four engineering faculties were invited to test their anxiety level and at the same time to select them for biofeedback training respondents. The test found that 194 students showed indications of high anxiety levels. 92 students were male (20.0%) and 113 were female (55%). Seventy-three (35%) students from FKKSA, twenty-seven students (13%) from FKEE, thirty-four students (17%) from FKM, and seven-one students (35%) from FKASA. Ninety-six students (61.5%) did not report a history of anxiety, and 60 students (38.5%) reported a history of anxiety. The low anxiety of the sample yield 11 students (5%) and high anxiety was 194 students (95%). Demography of respondents is presented in Table 4.2.

Table 4.2: Demography of respondents for correlation test

Demographic figures	Frequency	Percentage
1. Gender		
Male	92	45
Female	113	55
2. Faculty		
FKKSA	73	35
FKEE	27	13
FKM	34	17
FKASA	71	35
3. STAI		
Low STAI	11	5
High STAI	194	95
Total	205	

4.2.3 Gender Differences in Anxiety Level

A total of 205 students, consists of 92 male (20.0%) and 113 female (55%). The analysis was calculated to find out significant differences of anxiety between male and female students. Incidentally, males and female on average had anxiety (M = 96.59; M = 94.96, respectively). The results demonstrate no significant different between male in female in anxiety level. State and Trait shows no significant between male and female (t (91) = .346, p = .730; t (91) = .746, p = .457, respectively). Similarly, STAI demonstrate no significant for male and female (t (91) = -.894, p = .374). Table 4.3 presented the results. The results are consist with the prior study (Soetanto et al., 2004)., researcher conducted test for one hundred and twenty six Hong Kong Chinese adults responded with Chinese version of the State-Trait Anxiety Inventory (STAI-Y) was used to assess state and trait anxiety of respondents. Soetanto et al. (2004) found there was no significant gender difference in state and trait anxiety.

Table 4.3: Gender differences in anxiety level

Measure	Gender	M	SD	t-value	Sign (p)
State				.346	730**
	Male	44.28	6.706		
	Female	43.88	8.615		
Trait				.746	457**
	Male	46.76	6.846		
	Female	45.99	8.701		
STAI				-.894	374**
	Male	94.96			
	Female	96.59			

Note. M = mean, SD = Standard Deviation, *significant if p <.05

** not significant if p > .05

4.2.4 Biofeedback Training Respondents

Seventy healthy students were selected for the training: 32 (45.71%) males and 38 (54.29%) females. These students are only from three faculties: FKKSA, fifty students (71.43%), FKASA, thirty students (10%), and FKM seven students (18.57%). Table 4.4 displays the demography of the training respondents. They are randomly assigned into the training group and the non training group.

Table 4.4: Demographic of training respondents

Demographic info	Frequency	Percentage
1. Gender		
Male	32	45.71
Female	38	54.29
2. Faculty		
FKKSA	50	71.43
FKM	7	10
FKASA	13	18.57
3. Age (Year)		
18 – 20	8	11.42
21 – 23	59	84.29
24 – 26	3	4.29
27 – 3	-	-
4. GPA		
> 1.70	10	14.29
1.70 – 2.20	33	47.14
2.21 - 2.50	27	38.57
5. Health Problems	-	-
6. Study Problems	-	-

Equivalence of training – non-training group is shown in the following tables, where no significant differences were found on physiological arousal (Table 4.5), on STAI scores (Table 4.6), and academic performance (Table 4.7). Physiological arousal was calculated from heart rate (beat per-minute/BPM) with $p = .315$ and respiration rate (breath per-minute/bpm) with $p = .249$. STAI was measured for State with $p = .368$ and Trait with $p = .255$. Academic performance was considered with GPA $p = .459$. Independent sample *t*-test analysis was used to determine the equivalence both of groups.

Table 4.5: Equal variance of groups on Physiological Arousal

Measure	Group	M	SD	T	Sign (*p*)
Heart rate				1.013	.315*
	Training	82.77	10.36		
	on-training	85.09	8.66		
Respiratory				1.163	.249*
	Training	17.31	3.59		
	on-training	18.21	2.85		
Nijmegen				.464	.646*
	Training	16.29	4.669		
	on-training	15.71	5.814		

Note. M = mean, SD = Standard Deviation, *significant if p < .05

** not significant if p >.05

Table 4.6: Equal variance of groups on Cognitive Anxiety

Measure	Group	M	SD	T	Sign (*p*)
State				.906	.368*
	Training	50.17	7.63		
	on-training	48.69	5.98		
Trait				1.148	.255*
	Training	51.37	7.56		
	on-training	48.49	6.09		
SAS				.820	.418*
	Training	29.43	3.604		
	on-training	27.09	9.044		

Note. M = mean, SD = Standard Deviation, *significant if p < .05

** not significant if p >.05

Table 4.7: Equal variance of groups on academic performance

Measure	Group	Mean	SD	*t*	Sign (p)
GPA				.745	.459*
	Training	2.11	.29		
	Non-training	2.16	.26		

Note. *significant if p < .05 ** not significant if p >.05

4.3 Normality Test of Data

Normality test is a test to determine whether sample data differ significantly from normal distribution or not. The Kolmogorov-Smirnov test and Shapiro-Wilk (K-S) is used to compare the scores in the sample to a normal distribution set of scores with the same mean and standard deviation (Field, 2005). The K-S test can be accessed through the explore order in descriptive statistics. If the test is not significant ($p > .05$) it tells that a normal distribution. On opposite, the test is significant ($p < .05$) then the distribution is not normal. When data was found to be of non-normal distribution, all of the data are log transformed. Log transformation is conducted by Lg10 of set numbers that squash the right tail of the distribution (Field, 2005). The test statistics for the K-S test is represented by *D*.

Normality test of each data, such as State, Trait, SAS, Nijmegen test, GPA, heartbeat per-minute (BPM), and breath per minute (bpm) are conducted in pre post training of both groups. In addition, though all of data outcome across pre post training met normality assumption include State, Nijmegen, SAS, GPA, BPM, and bpm. Only Trait was distribute not normal. Distribution data of State for the training group in pre post training was normal (D (35) = .136, p = .099; D (35) = .170, p = .0.60, respectively). State for non-training group in pre post training also show normality (D (35) = .169, p = 0.78; D (35) = .118, p = .200, respectively). Normality also shows for SAS in pre post training both of groups (D (35) = .089, p = .200; D (35) = .103, p = .200; D (35) = .107, p = .200, D (35) = 134, p = .114, respectively). For Nijmegen, during pre post training both of groups were normal (D (35) = .133, p = .123; D (35) = .113, p = .200; D (35) = .141, p = .076; D (35) = .133, p = .120, respectively). Distribution of GPA for training group during pre post training was normal (D (35) = .157, p = .082; D (35) = 0.56, p = .200, respectively). GPA for the non-training group also show normal distribution (D (35) = .117, p = .200; D (35) = .135, p = .104, respectively). Similarly, data of BPM and bpm for the training group during pre post training were normal (D (35) = .081, p = .200; D (35) = .127, p = .166; D (35) = .097, p = .200; D (35) = .094, p = .200, respectively). BPM and bpm for the non-training group in pre post training also show normal distribution (D (35) = .143, p = .066; D (35) =

.144, *p* = .065; *D* (35) = .089, *p* = .200; *D* (35) = .132, *p* = .131, respectively). Thus subsequent were analyze using parametric statistics (Paired samples t-test/t-value).

Violation of normality assumptions was noted for the Trait in pre training both of groups (*D* (35) = .160, *p* = .023; *D* (35) = .181, *p* = .005, respectively). Conversely, Trait data in post training both of groups noted normality (*D* (35) = .113, *p* = .200; *D* (35) = .125, *p* = .187, respectively). Transforming Trait data with log transformation, however did not improve the normality for pre data, the subsequent analysis was carried out using non parametric statistics (Wilcoxon signed-rank/z-value). Table 4.8 shows the results of the normality test.

Table 4.8: Result of normality test

Measures	Groups	Time	M	SD	D Statistic	Sign (p)
State	Training	Pre	49.71	7.991	.136	.099*
		Post	20.74	4.674	.170	.060*
	Non-training	Pre	46.11	3.756	.169	.078*
		Post	43.14	5.419	.118	.200*
Trait	Training	Pre	49.63	8.015	.160	.023**
		Post	21.83	5.798	.113	.200*
	Non-training	Pre	48.49	6.099	.181	.005**
		Post	46.03	7.414	.125	.187*
SAS	Training	Pre	29.43	13.604	.089	.200*
		Post	14.60	8.617	.103	.200*
	Non-training	Pre	27.09	9.044	.107	.200*
		Post	25.09	9.448	.134	.114*
Nijmegen	Training	Pre	16.29	4.669	.133	.123*
		Post	10.11	6.420	.113	.200*
	Non-training	Pre	15.71	5.814	.141	.076*
		Post	13.57	6.418	.133	.120*
GPA	Training	Pre	2.112	.295	.157	.082*
		Post	2.653	.539	.056	.200*
	Non-training	Pre	2.162	.261	.117	.200*
		Post	2.452	.227	.135	.104*
BPM	Training	Pre	82.77	10.367	.081	.200*
		Post	72.43	5.484	.127	.166*
	Non-training	Pre	87.66	9.923	.143	.066*
		Post	82.14	8.388	.144	.065*
Bpm	Training	Pre	17.31	3.595	.097	.200*
		Post	6.64	1.837	.094	.200*
	Non-training	Pre	18.21	2.856	.089	.200*
		Post	17.55	3.066	.132	.131*

Note. M = mean, SD = standard deviation, *significant if p > .05,

** not significant if p < .05

4.4 Verification of Intervention Effects

The results for the training group were determined whether the techniques applied can help reduce study anxiety and consequently improve their academic performance. Physiological assessment was measured during each training session to control the respondents' progress in reducing anxiety. The hypotheses testing are explained below.

4.4.1 The Significant Sources of Study Anxiety among Engineering Students

Hypothesis one predicted that seven sources will show significant created study anxiety among engineering students. A survey was conducted among engineering undergraduate students in Universiti Malaysia Pahang to identify sources of study anxiety. The results show that seven sources are significant as study anxiety sources among engineering students at UMP. Table 4.9 presented the results. The criteria for the identification of study anxiety sources are as follows:

a. Exam anxiety is the main source of study anxiety with t (1.769) = 172.298; p = .000; M = 25.75; SD = 4.066. Highest score for exam anxiety is related to Question 8: "How often do you feel anxious during examinations due to lack of preparation?" The students indicated insufficient study is the main cause of exam anxiety.
b. Social anxiety is a significant source of study anxiety with t (1. 769) = 110.095; p = .000; M = 20.33; SD = 4.999. Highest score for social anxiety is for Question 7: "How often do you face difficulty to study when there are many members in a room?" The students face difficulty to study when there are too many roommates.
c. Presentation anxiety is shown to be a significant source of study anxiety with t (1.769) = 123.651; p = .000; M = 16.91; SD = 3.684. Highest score for presentation anxiety is for Question 17: "How often do you feel that your heart beats very fast while making class presentation?" The students stated that their heart beats very fast, a symptom of anxiety, while giving class presentation.
d. Mathematics anxiety is found to be a significant source of study anxiety with t (1.769) = 140.616; p = .000; M = 16.60; SD = 3.178. Highest score for mathematics anxiety is for Question 39: "How often do you feel anxious when you could not

understand the mathematic subject?" Mathematics being one of the difficult subjects makes the students feel anxious when they do not understand the subject.

e. Language anxiety is confirmed to be a significant source of study anxiety with *t* (1.769) = 131.234; *p* = .000; *M* = 16.33; *SD* = 3.346. Highest score for language anxiety is for Question 30: "How often do you feel anxious because of lack of confidence while taking language class?" Students' perception of language classes can increase anxiety due to lack of confidence.

f. Family anxiety is shown to be a significant source of study anxiety with *t* (1.769) = 79.026; *p* = .000; *M* = 11.12; *SD* = 3.728. Highest score of family anxiety is for Question 35: "How often do you feel that your family problems can increase your anxiety during study?" However, family problems can be a potential cause of study anxiety.

g. Library anxiety is found to be a significant source of study anxiety with *t* (1.769) = 61.271; *p* = .000; *M* = 9.52; *SD* = 4.087. The highest score of library anxiety is for Question 20: "How often do you feel embarrassed when you are not able to use the library?" Library anxiety can affect study anxiety, as being embarrassed is a bad experience which could make student feel anxious to visit the library.

Table 4.9: Significant sources of Study Anxiety

Sources	M	SD	t	Sign (p)
Exam	25.75	4.066	172.298	.000*
Social	20.33	4.999	110.095	.000*
Presentation	16.91	3.648	123.651	.000*
Mathematics	16.60	3.178	140.616	.000*
Language	16.33	3.346	131.234	.000*
Family	11.12	3.728	79.026	.000*
Library	9.52	4.087	61.271	.000*

Note. M = mean, SD = standard deviation, * significant if p < .05

4.4.2 The Relationship of Study Anxiety and Academic Performance among Engineering Students

Hypothesis two predicted that there will be significantly correlated between study anxiety and academic performance among engineering students. The data was

normal distributed and analyzed using Pearson correlation to examine the relationship between anxiety and academic performance. The results obtained are as follows: the mean and standard deviation of STAI (*M* = 95.53; *SD* = 12.008) and GPA (*M* = 2.185; *SD* = .250), a significant correlation (*p* = .000), the correlation coefficient is small with *r* = -.264, and finally the sample size yield n = 205. The relationship show negative correlation with a small Pearson correlation coefficient. Therefore, it can be concluded that there is a significant relationship between high level anxiety and low academic performance among UMP's students. As such, the hypothesis (Ha_2) is accepted. The results are presented in Table 4.10.

Table 4.10: Correlation of study anxiety and academic performance

Measures	M	SD	r	Sign (p)
STAI	95.53	12.008		
GPA	2.185	.250		
STAI-GPA			-.264	.000*

Note. M = Mean, SD = Standard deviation, * significant if p < .05

4.4.3 Changes of Physiological Arousal across Four Sessions among The Training Group

Hypothesis three predicted that students in the training group will show significant of changes across four sessions of physiological arousal. Using repeated measures ANOVA, the physiological data is examined and found to be normally distributed. The data measured during the 1st session, 4th session, 7th session, and 10th session was compared for differences (Lagos et al., 2008). Biofeedback device was used to measure changes of heartbeat and respiration rates over the period of the ten training sessions. Heartbeat rate in beat-per-minute is displayed with the red waveform and respiration rate in breath-per-minute is displayed with the green waveform. The physiological responses of the respondents in the training group show differences over time. The feedback indicates that the waveforms were not smooth at first, but changes occur with each session. The results show smooth waveforms as an indication of better physiological condition of respondents. A smooth waveform shows that the respondents is using slow diaphragm breathing, which results in a stable heart rate, and they are in a

relaxed state. In the relaxed condition, the red and green waveforms merge into one waveform. This proves the effects of the interventions given to the training group.

The physiological responses of one participant in the training group were recorded and are shown in Table 4.11. Figure 4.1 illustrated of the in physiological arousal for training group. The Ha_3 is hence accepted that the results show a significant difference of physiological assessment among the training group.

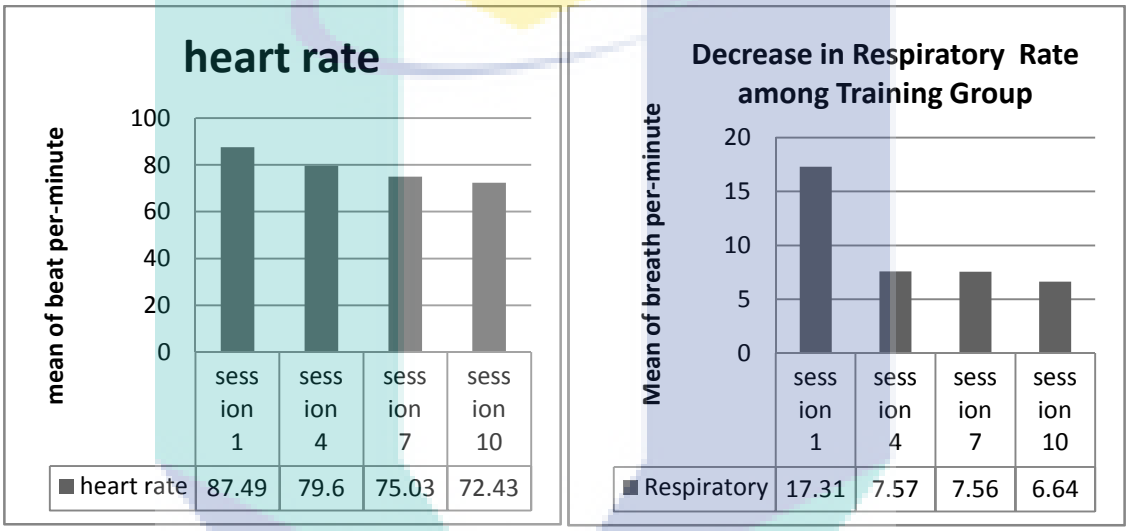
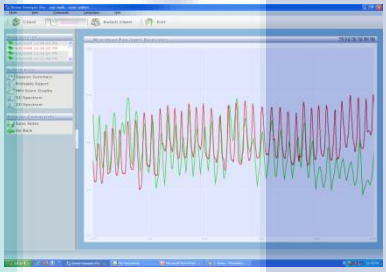
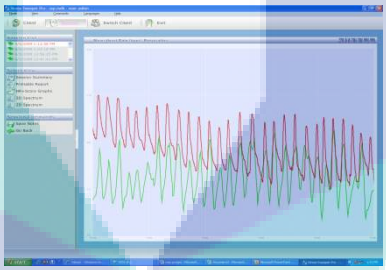
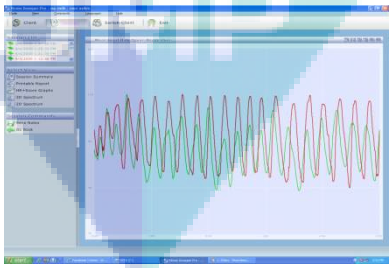


Figure 4.1: Mean score of difference time changes in physiological arousal for training group

Table 4.11: Comparison of time changes in physiological arousal

Sessions	BPM	bpm	Display of Physiological Arousal Output	Interpretation
1	95	18.6		- Heartbeat is represented by the red waveform. The subject has 95 BPM; fast heartbeats may indicate anxiety disorder. - Respiration is represented by the green waveform. The subject has 18.6 bpm; rapid breathing maybe due to high anxiety.
4	77	10.4		- After the intervention, subject's heartbeat has reduced to 77 BPM. - Also, his respiration has reduced to 10.4 bpm. - This means that the subject's anxiety has improved over the 1st session.
7	80	7.2		- The subject is more relaxed during the 7th session; heartbeat is 80 BPM and respiration is 7.2 bpm.
10	68	4.8		- Assessment indicates that the participant is able to overcome their physiological arousal due to anxiety. - Both waveforms merge into one, meaning that the participant in relaxed condition. - Heartbeat is 68 BPM and respiration is 4.8 bpm - Technical interventions succeeded in reducing anxiety disorders due to of physiological arousal

Source: A screen short of physiological arousal: Performance of a participant in the training group

Decrease in Heartbeat Rate

The results of repeated measures ANOVA shows that there is highly significant change over time in the heartbeat rate (beat-per-minute/BPM) of the respondents in the training group: F (3.102) = -22.012, p = .000 with a medium effect size ($\acute{\eta}^2$ = .393); also, there is a significant difference between the respondents: F (1.34) = -4.589; p = .000 with a large effect size ($\acute{\eta}^2$ = .992).

There is a decrease in beat-per-minute mean scores for the training group with HR_1 (M = 87.49, SD = 6.617), HR_4 (M = 79.60, SD = 8.434), HR_7 (M = 75.03, SD = 8.726), and HR_{10} (M = 72.43, SD = 5.485). Training group has applied the intervention techniques to cope with study anxiety resulting in reduced BPM between sessions one, four, seven, and ten. Table 4.12 shows the change in the heartbeat of the training group. Figure 4.2 shows the estimated heart rate mean score for the four sessions among training group.

Table 4.12: Changes in time of beat-per-minute among the training group

Time	M	SD	f	Sign (p)	Effect size ($\acute{\eta}^2$)
Session 1	87.49	6.617			
Session 4	79.60	8.434			
Session 7	75.03	8.726			
Session 10	72.43	5.485			
Time			-22.012	.000*	.393
Between Subject			-4.589	.000*	.992

Note. M = mean, SD = standard deviation, * significant if p < .05

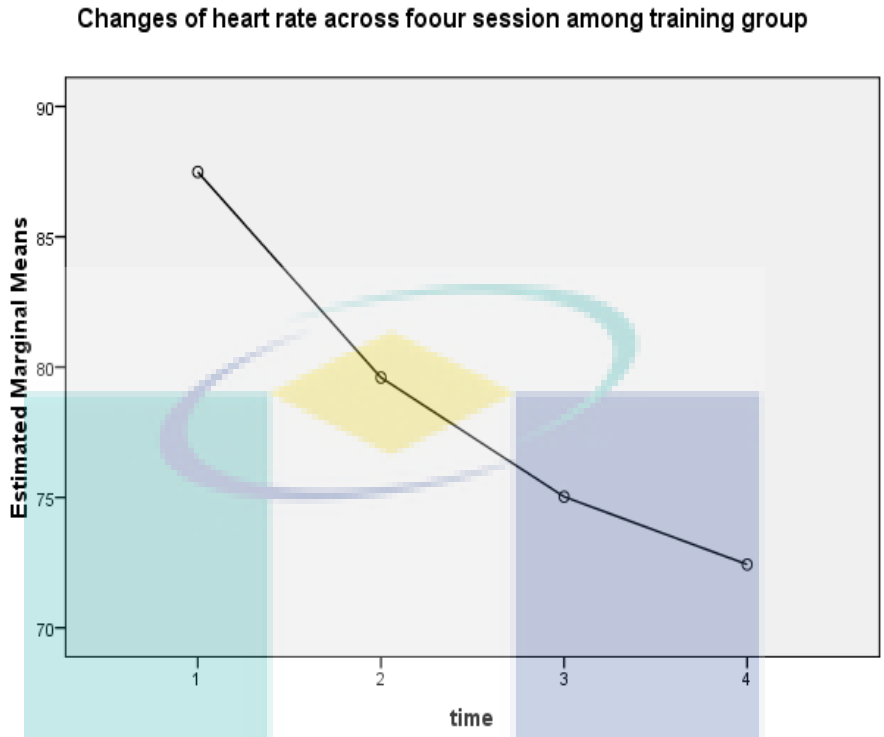


Figure 4.2: Estimate of BPM over four sessions

Decrease in Respiration Rate

Repeated measures ANOVA of respiratory data also show extremely significant difference over time in breath-per-minute (bpm) for the training group: F (4.35) = -229.429, p = .000 with large effect size ($\acute{\eta}^2$ = .871); also there is a significant difference between subjects: F (4.35) = -961.347; p = .000 with large effect size ($\acute{\eta}^2$ = .966).

There is a decrease of breath-per-minute mean scores for the training group: $resp_1$ (M = 17.31, SD = 3.595), $resp_4$ (M = 6.64, SD = 1.837), $resp_7$ (M = 7.56, SD = 2.295), and $resp_{10}$ (M = 6.64, SD = 1.837). There is a significant change of the respiration rate among the training group over the four sessions. Table 4.13 shows the results of changes in bpm among the training group, and Figure 4.3 shows the changes in time of bpm.

Table 4.13: Changes in time of breath-per-minute among the training group

Time	M	SD	F	Sign (p)	Effect size ($\acute{\eta}^2$)
Session 1	17.31	3.595			
Session 4	7.57	1.996			
Session 7	7.56	2.295			
Session 10	6.64	1.837			
Time			-229.429	.000*	.871
Between subjects effect			-961.347	.000*	.966

Note. M = mean, SD = standard deviation, * significant if p < .001

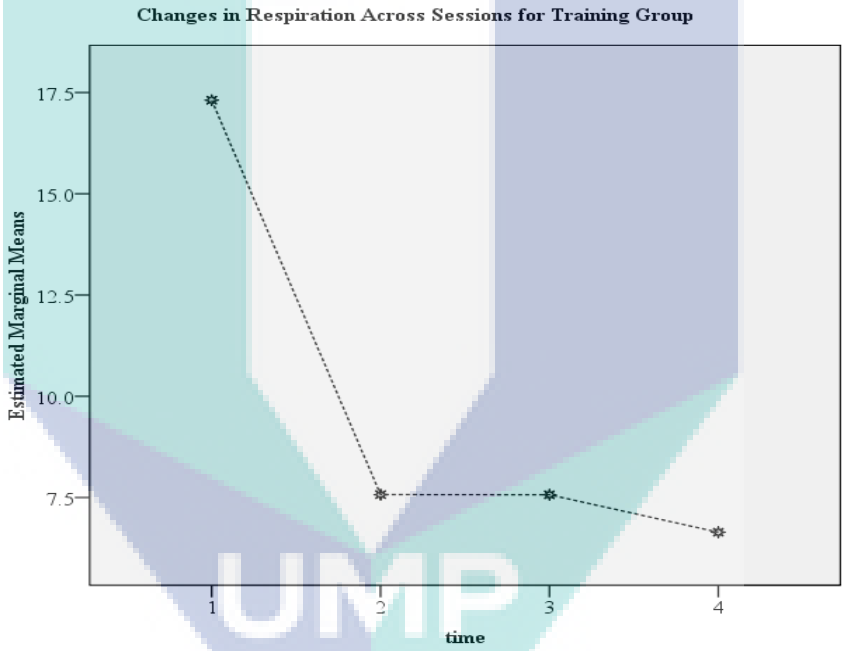


Figure 4.3: Estimated bpm over four sessions of training group

4.4.4 Physiological Arousal between Groups

Hypothesis four predicted that students who learned the intervention for ten sessions will show significant reduced of physiological arousal from pre to post than students who have not learned. The training group was received ten sessions to learn reducing anxiety and no session for the non training group. The physiological arousal was measure by beat per-minute (BPM), breath per-minute (bpm), and Nijmegen score.

Figure 4.4 displays the mean scores of physiological assessment in pre post training between groups.

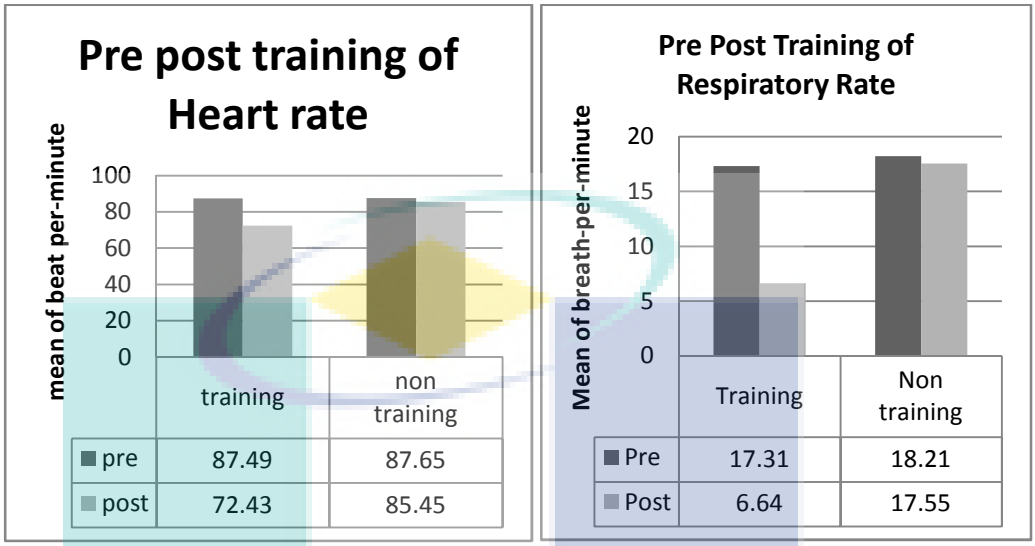
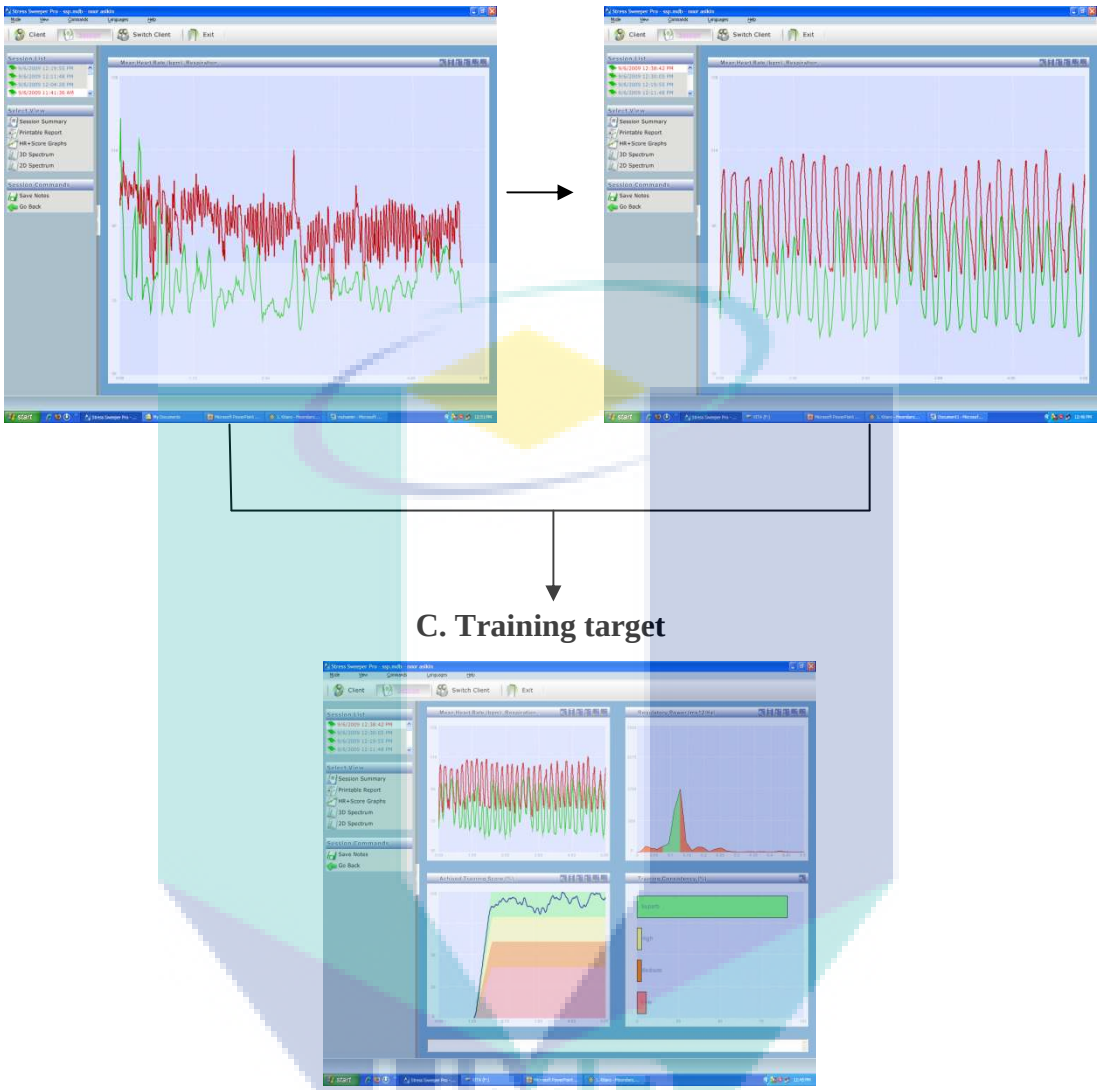


Figure 4.4: Mean score in pre post training of physiological arousal between groups

Biofeedback device was used to measure changes in heartbeats and respiration of the respondents. Heartbeat rate or beat-per-minute is displayed by a red waveform and respiration or breath-per-minute is displayed by a green waveform. The training group shows differences in physiological responses for pre post training. The feedback shows that the waveforms are not smooth in the pre training, but change into smooth waveforms in the post training. This is due to the effects of interventions provided to the training group. The non-training group shows no difference in physiological arousal in the pre post training. Figure 4.5 presents the comparison of pre and post-training in physiological arousal for the training group, while Figure 4.6 is the comparison for the non-training group.

A. Pre-Training **B. Post-Training**



C. Training target

Figure 4.5: Comparison of physiological arousal for training group

Where: A: the picture display unsmooth wave with 91BPM and 18 bpm

B: the picture display smooth wave with 71 BPM and 6.2 bpm

C: this picture shows that the practice of physiological techniques will produce smooth breathing and a slow heart rate thus achieving targets are met as shown in green zone in the picture (training score, heart rate spectrum, and the score brands)

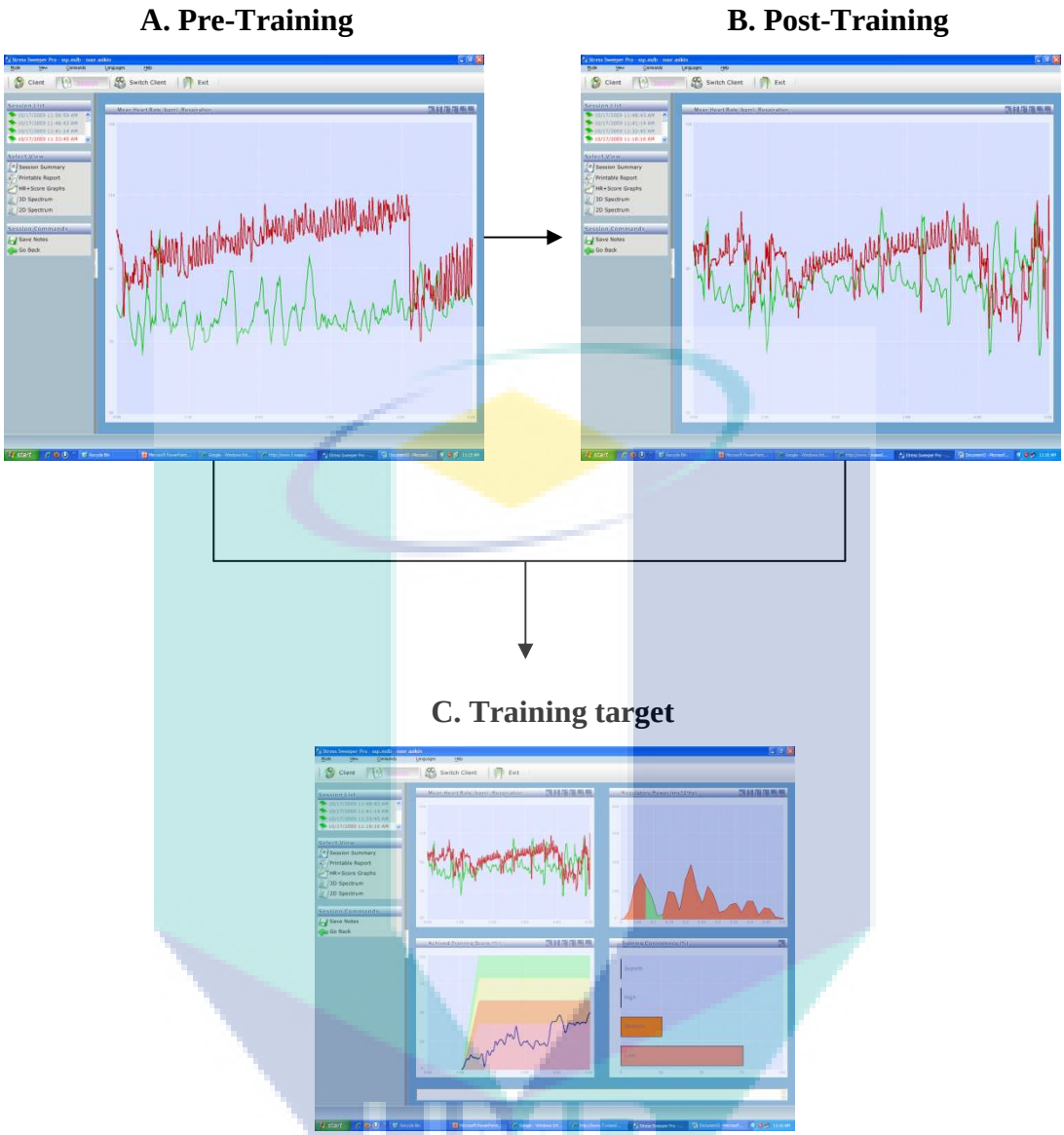


Figure 4.6: Comparison of physiological arousal for non-training group

Where: A: the picture display unsmooth wave with 89 BPM and 17.6 bpm.

B: the picture display not significant different compare with pre training, 87 BPM and 19 bpm.

C: this picture shows that that the target is not reached among the non-training group because they do not receive intervention as shown in the pictures are training score, heart rate spectrum, and the score brands on the outside of green zone.

Decrease in Heart Rate

Using Paired samples t-test, it is found that there is no significant difference of baseline (non-practice day, before training) with p = .130; for the training group there is greatly significant difference of pre post training with t (34) = -11.197; p = .000 and a large effect size ($\acute{\eta}^2$ = .761), whereas for the non-training group, the result shows that there is no significant difference in pre post training with t (34) = -1.321; p = .195 and a medium effect size ($\acute{\eta}^2$ = .415). The training group shows 14% improvement compared to 1% improvement for the non-training group. The results are shown in Table 4.14.

Table 4.14: Differences of Beat-Per-minute in Pre Post Training Between Groups

Group	Time	M	SD	t	Sign (p)	Effect size ($\acute{\eta}^2$)
Training				-11.197	.000*	.761
	Post	72.43	5.484			
	Pre	87.40	6.617			
Non-training				-1.321	.195**	.415
	Post	85.45	6.770			
	Pre	87.65	9.923			

Note. M = Mean, SD = Standard Deviation, * significant if p < .05,
** not significant if p < .05

There was decrease of beat-per-minute mean score for the training group compared to the non-training group. The mean scores for training group is (M_1 = 72.43, SD_1 = 5.484; M_2 = 87.40, SD_2 = 6.617 respectively), while that of the non-training group is (M_1 = 85.45, SD_1 = 6.770; M_2 = 87.65, SD_2 = 9.923 respectively). The results show that the training group can reduce the beat-per-minute score unlike the non-training group. Figure 4.7 shows the estimated mean differences for pre post training between groups.

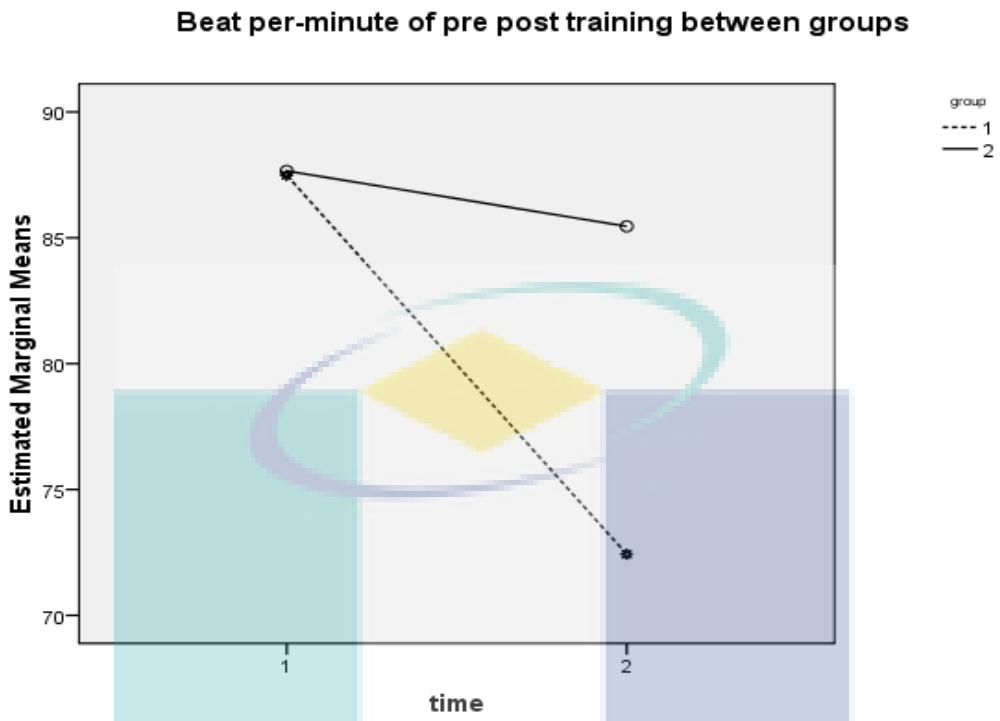


Figure 4.7: Estimated mean differences of beat-per-minute in pre post training between groups

Decrease in Respiration Rate

For respiration rate, the results of Paired samples t-test show that there is no significant difference of baseline (non-practice day, pre training) with p = .270; for the training group, there is highly significant difference effect of pre post training with t (34) = -18.376; p = .000 and large effect size ($\acute{\eta}^2$ = .952), whereas the non-training group there is no significant difference of the physiological arousal with t (34) = -0.980; p = .334 with small effect size ($\acute{\eta}^2$ = .164). The training group shows 61% improvement compared to 4% improvement for the non-training group. The results are shown in table 4.15.

There is a decrease of breathing mean score for the training group compared to the non-training group. The mean score in post pre for the training group is (M_1 = 6.64, SD_1 = 1.837; M_2 = 17.31, SD_2 =3.595 respectively), while that post pre of the non-

training group was (M_1 = 17.55, SD_1 = 3.066; M_2 = 18.21, SD_2 = 2.856 respectively). The results show that the training group can reduce the state score compared to the non-training group. Figure 4.8 presents the estimated mean differences in breath-per-minute in pre post training between groups.

Table 4.15: Differences of Breath-Per-Minute in Pre Post Training Between Groups

Group	Time	M	SD	t	Sign (p)	Effect size ($\acute{\eta}^2$)
Training				-18.376	.000*	.952
	Post	6.64	1.837			
	Pre	17.31	3.595			
Non-training				-0.980	.334**	.164
	Post	17.55	3.066			
	Pre	18.21	2.856			

Note. M = mean, SD = standard deviation, *significant if p < .05,
** not significant if p < .05

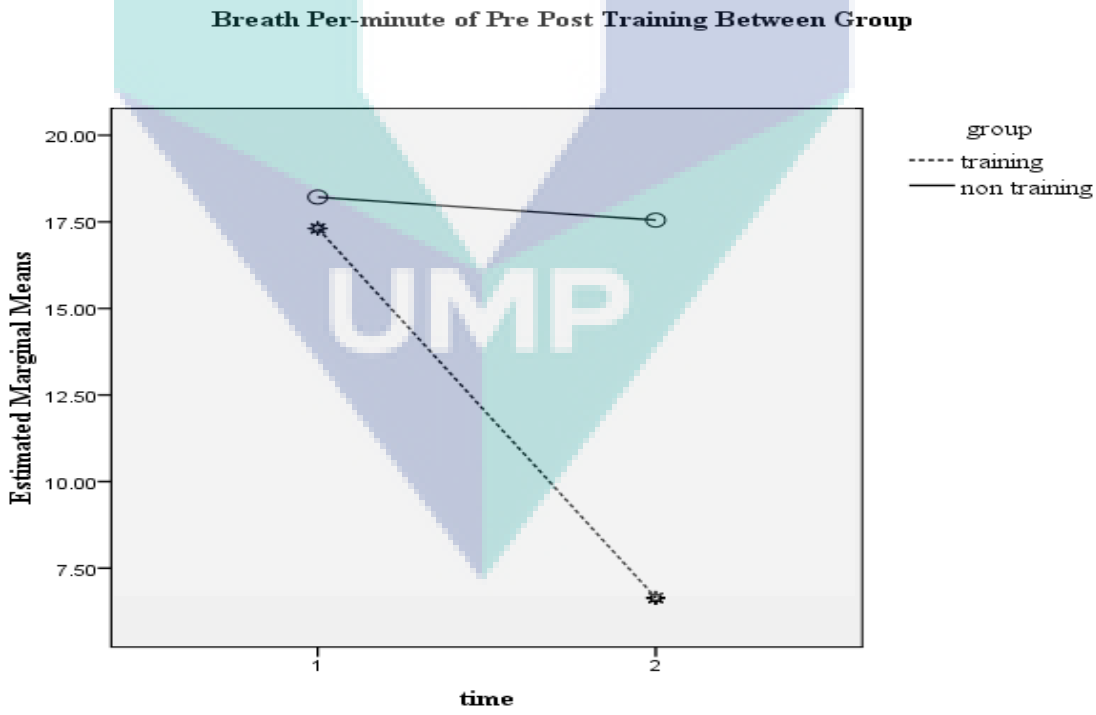


Figure 4.8: Estimated mean differences of breath-per-minute for pre post training between groups

Decrease in Nijmegen Questionnaire

The results of Paired samples t-test show that there is no significant difference of baseline (non-practice day, pre training) with t = .646; for the training group found highly significance difference of pre-post training with t (34) = -6.108; p = .000 with large effect size ($\acute{\eta}^2$ = *.723*), whereas for the non-training group there is no significant difference with t (34) = -1.543; p = .132 with small effect size ($\acute{\eta}^2$ = .255). The training group has reduced the anxiety level by 49% compared to 12% reduction in the non-training group. The results are presented in table 4.16.

Table 4.16: Differences of Nijmegen in pre post training between groups

Group	Time	M	SD	t	Sign (p)	Effect size ($\acute{\eta}^2$)
Training				-6.108	.000*	.723
	Post	10.11	6.42			
	Pre	19.74	9.52			
Non-training				-1.543	.132**	.255
	Post	17.19	9.85			
	Pre	19.37	9.52			

Note. M = mean, SD = standard deviation, * significant if p < .05,
** not significant if p < .05

There is a decrease of Nijmegen mean score in pre post training for the training group compared to the non-training group. The mean scores post pre for the training group is (M_1 = 10.11, SD_1 = 6.42; M_2 = 19.74, SD_2 = 9.52 respectively), while that post pre of the non-training group is (M_1 = 17.19, SD_1 = 9.85; M_2 = 19.37, SD_2 = 9.52 respectively). Nijmegen score showing the reduction of anxiety level can be seen in Figure 4.9.

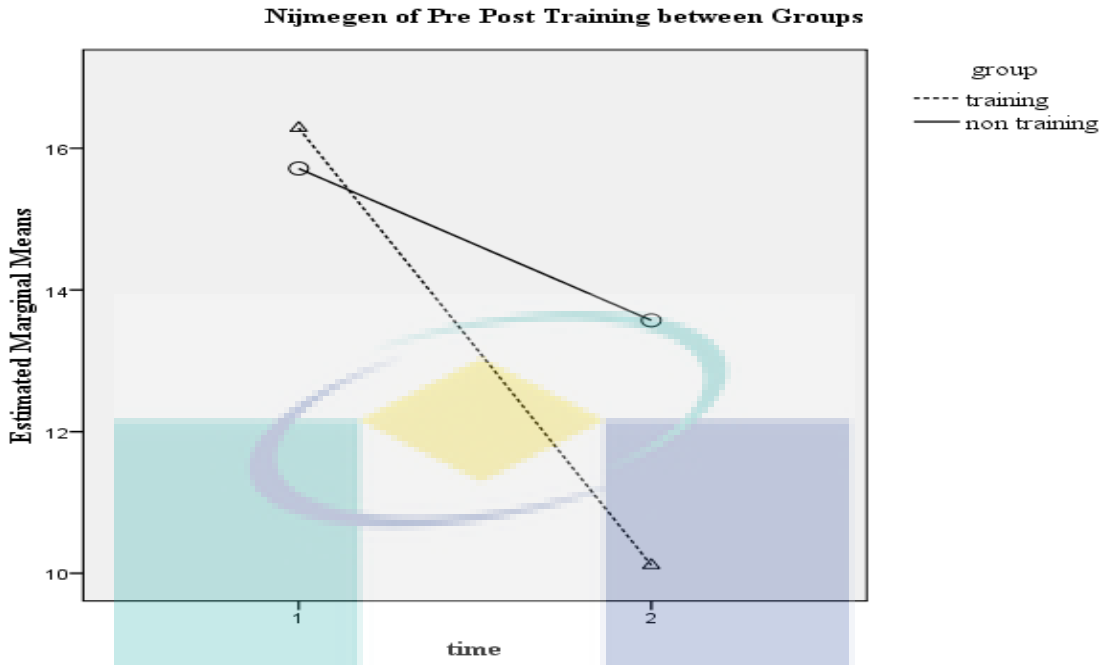


Figure 4.9: Nijmegen score reduce in pre to post training by groups

4.4.5 Cognitive Anxiety

Hypotheses five predicted that students who received the intervention for ten sessions will show significant decreased of cognitive anxiety form pre to post than students who have not received. The cognitive anxiety was measure by State, Trait, and SAS scores than non-training group from pre to post. Using Paired samples t-test to compare the two groups, the data of State and Trait are found to be normally distributed. On the opposite, the Trait data was not normal distributed and used Wilxozon signed-rank test (non-parametric version for Paired samples t-test) to evaluate of differences between groups. Figure 4.10 displays mean scores of anxiety level in pre post training between groups measured by State, Trait, and SAS.

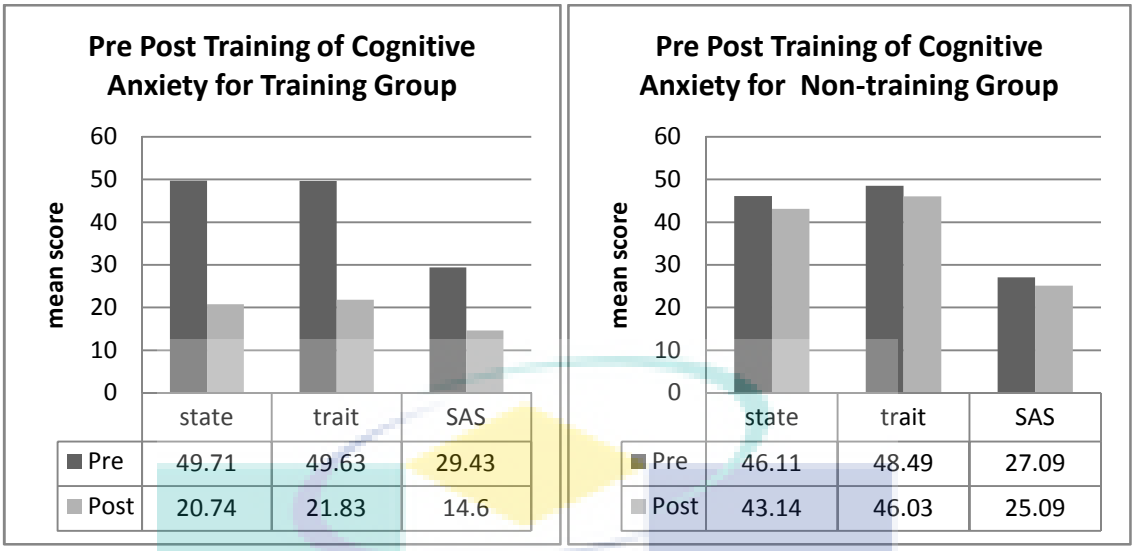


Figure 4.10: Mean score of anxiety level in pre post training between groups

Decrease in the S-Anxiety scale (STAI Form Y-1)

The results of Paired samples t-test show that there is no significant difference of baseline (non-practice day, pre training) with p = .107 between the training group and non-training group. The training group experience a 58% decrease in State while the decrease is only 6% for non-training group; hence there is a decrease of state mean score for the training group compared to the non-training group. The mean score in post pre for the training group are (M_1 = 20.74, SD_1 = 4.67; M_2 = 49.71, SD_2 = 7.99 respectively), while that post pre of the non-training group are (M_1 = 43.14, SD_1 = 5.41; M_2 = 46.11, SD_2 = 3.71 respectively). The estimated marginal means of pre post training between groups are shown in Figure 4.11.

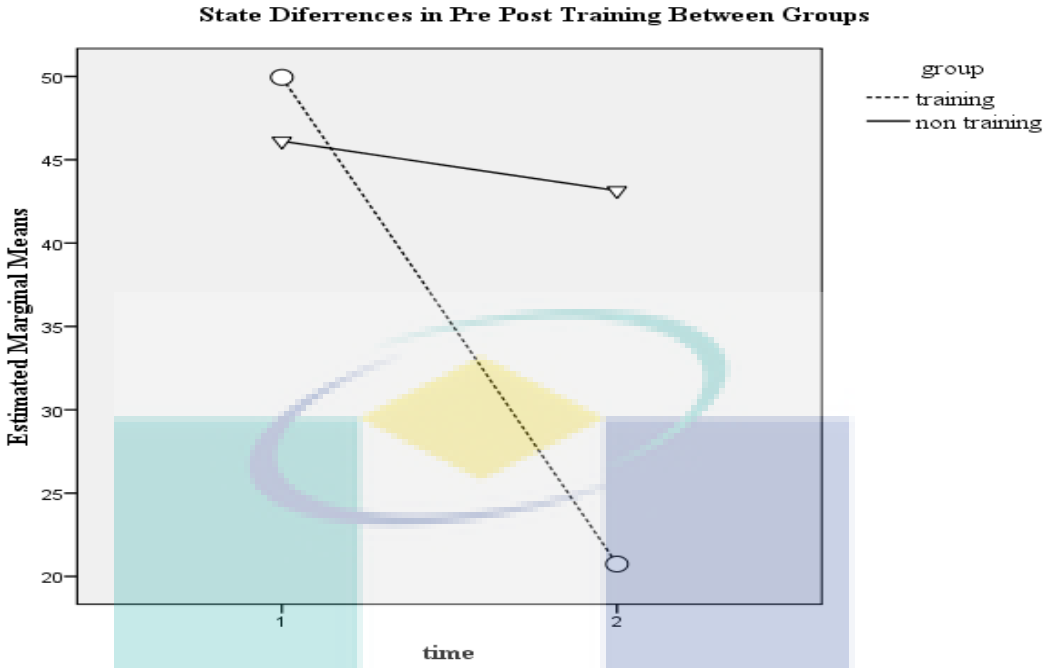


Figure 4.11: The estimated marginal means in pre post training between groups

The training group shows highly significant difference of pre post training with t (34) = -21.885; p = .000 and a large effect size ($\acute{\eta}^2$ = .964), whereas the non-training group shows no significant difference in pre post training with t (34) = -2.905; p = .006 and a medium effect size ($\acute{\eta}^2$ = .445). Table 4.17 presents the results.

Table 4.17: Differences of state in pre post training between groups

Group	Time	M	SD	t	Sign (p)	Effect size ($\acute{\eta}^2$)
Training				-21.885	.000*	.964
	Post	20.74	4.67			
	Pre	49.71	7.99			
Non-training				-2.905	.006**	.445
	Post	43.1	5.41			
	Pre	46.11	3.71			

Note. M = mean, SD = standard deviation, *significant if p < .05,

**not significant if p < .05

Decrease in the T-anxiety scale (STAI Form Y-2)

The results of Wilcoxon signed-rank test found no significant difference in baseline (non-practice day, pre training) with p = .166 between the training group and the non-training group. The training group has reduced the Trait mean score and shows highly significant difference of pre post training with z = -5.162, p = .000 and a large of effect size ($\acute{\eta}^2$ = 1.155). The non-training group did not have a significant difference of pre post training with z = -1.223, p = .221 and a small effect size ($\acute{\eta}^2$ = .272). The results are shown in Table 4.18.

Table 4.18: Differences of trait in pre post training between groups

Group	Time	M	SD	z	Sign (p)	Effect size ($\acute{\eta}^2$)
Training				-5.16	.000*	.863
	Post	21.83	5.79			
	Pre	49.63	8.01			
Non-training				-1.22	.221**	.272
	Pre	46.03	7.41			
	Post	48.49	6.09			

Note. M = mean, SD = standard deviation, * significant if p < .05,
** not significant if p < .05

Mean score of the training group shows a decrease in the pre post training when compared to that of the non-training group. The mean scores in post pre for the training group are (M_1 = 21.83, SD_1 = 5.79; M_2 = 49.63, SD_2 = 9.47 respectively), whereas that post pre of the non-training group are (M_1 = 46.03; SD_1 = 7.41; M_2 = 48.49, SD_2 = 6.09 respectively). The results show that the training group has a reduction of 56% in anxiety level compared to only 5% reduction in the non-training group. Figure 4.12 shows the differences of mean score in pre post training.

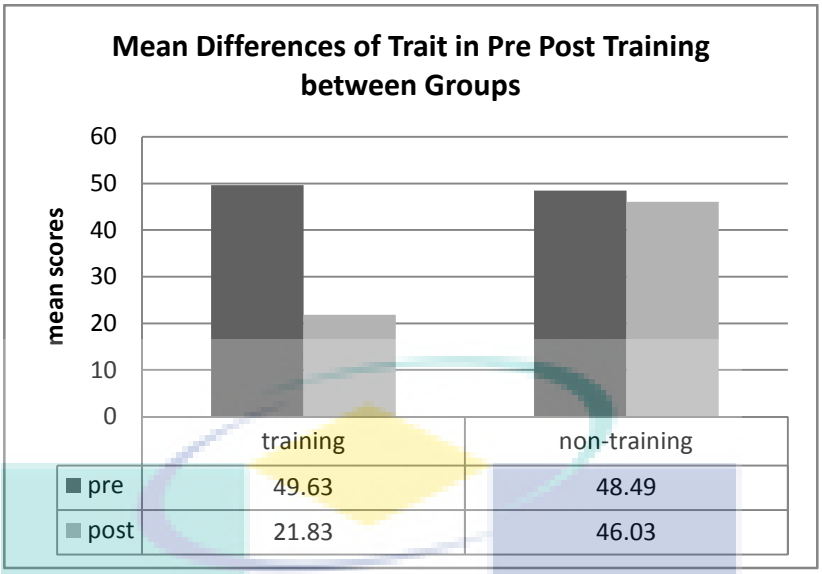


Figure 4.12: Mean diffrences of trait in pre post training between groups

Decrease in Study Anxiety Scale (SAS)

For SAS score, the Paired samples t-test shows there is no significant difference of baseline (non-practice day, pre training) with p = .418; highly significant difference of time effect is found in the pre-post training among the training group with t (34) = -11.306; p = .000 and a large effect size ($\acute{\eta}^2$ = .888), whereas the non-training group shows no significant difference with t (34) = -1.245; p = .222 and a small effect size ($\acute{\eta}^2$ = .208). The training group has a reduction of 50% in anxiety level compared to 7% reduction in the non-training group. Table 4.19 presents the results.

There is a significant decrease in SAS mean scores for the training group compared to that of the non-training group. The mean scores in post pre for the training group are (M_1 = 14.60, SD_1 = 8.61; M_2 = 29.43, SD_2 = 13.60 respectively) and that post pre of the non-training group are (M_1 = 25.09, SD_1 = 9.44; M_2 = 27.09, SD_2 = 9.04 respectively). SAS scores of pre post training between groups are shown Figure 4.13.

Table 4.19: Differences of SAS in pre post training between groups

Group	Time	M	SD	t	Sign (p)	Effect size ($\acute{\eta}^2$)
Training				-11.306	.000*	.888
	Post	14.60	8.61			
	Pre	29.43	13.60			
Non-training				-1.245	.222**	.208
	Post	25.09	9.44			
	Pre	27.09	9.04			

Note. M = mean, SD = standard deviation, * significant if p < .05,
** not significant if p < .05

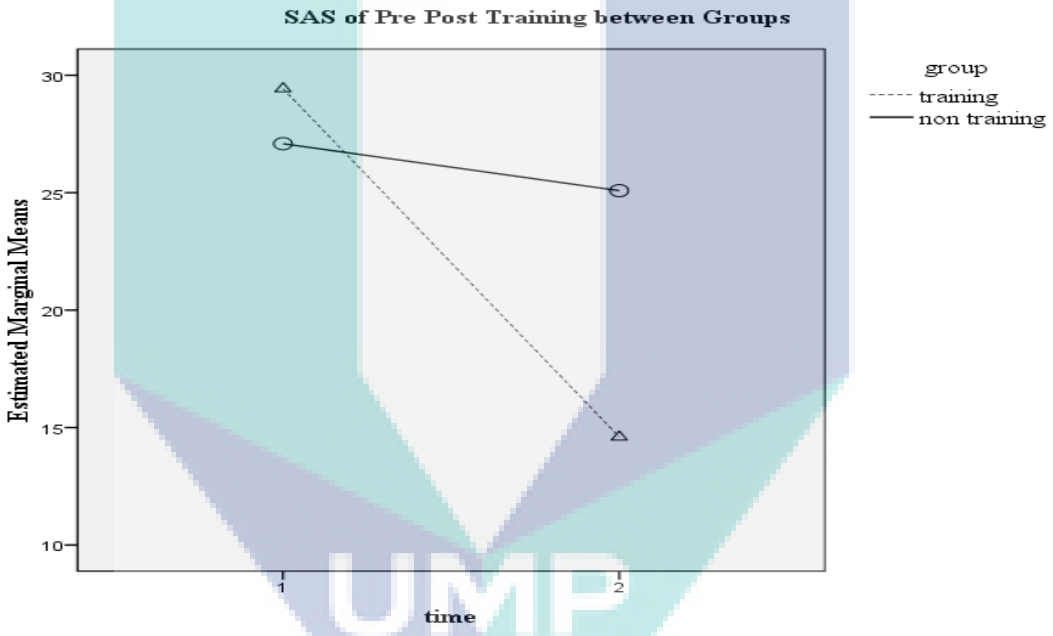


Figure 4.13: Reduce of SAS score in pre post training by groups

4.4.6 Academic Performance

Hypothesis six predicted that students who learned the intervention for ten sessions will show increase GPA than students who have not learned. The results of Paired samples t-test shows there is no significant difference of baseline (non-practice day, pre training) with p = .493; for the training group there is highly significant difference in time effect of pre-post tests with t (34) = 6.224; p = .000 and a large effect

size ($\acute{\eta}^2$ = .729), and also there is a significant difference for the non-training group with t (34) = 3.767; p = .001 and a large effect size ($\acute{\eta}^2$ = .542). The training group achieves a 25% improvement in their academic performance compared to 7% improvement in the non-training group. Table 4.20 presents the results.

Table 4.20: Differences of GPA in pre post training between groups

Group	Time	M	SD	t	Sign (p)	Effect size ($\acute{\eta}^2$)
Training				6.224	.000*	.729
	Post	2.62	.539			
	Pre	2.11	.295			
Non-training				3.767	.001**	.542
	Post	2.35	.228			
	Pre	2.20	.257			

Note. M = mean, SD = standard deviation, * significant if p < .05,
** not significant if p < .05.

There is improvement in the GPA mean score in pre post training for the training group compared to the non-training group. The GPA mean score in post pre for the training group are (M_1 = 2.62, SD_1 = .539; M_2 = 2.11, SD_2 = .295 respectively) and that post pre for the non-training group are (M_1 = 2.35, SD_1 = .228; M_2 = 2.20, SD_2 = .257 respectively). The academic performance improvement is displayed in Figure 4.14.

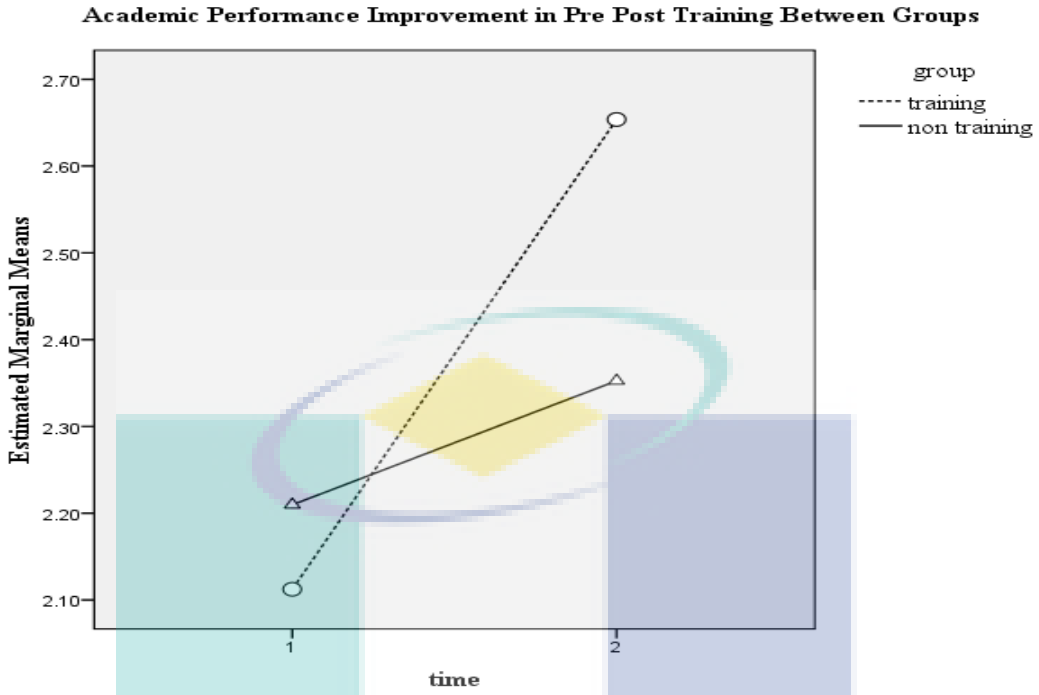


Figure 4.14: GPA improvement in pre to post training by groups

4.4.7 Assessment of Theoretical Model

Hypothesis seven predicted that there will be significant correlation between changes in anxiety to academic performance. According to the Catastrophe model theory of relationship between anxiety and performance (Fazey and Hardy, 1988), anxiety is seen as physiological arousal and cognitive anxiety with regard to performance. This theory has three predicted, for the first prediction when cognitive anxiety is high, it will increase the level of physiological arousal to drop performance. Second prediction, cognitive anxiety will have a negative relationship with performance when physiological arousal is high. Third prediction, when physiological arousal is low, cognitive anxiety has a positive relationship with performance. For interference scores, lower breathe per-minute and State scores reflected lesser anxiety, higher GPA scores reflected greater improvement.

Multiple linear regression analysis was used to examine whether the model is successful in predicting of significant correlation between change in anxiety to

academic performance. At pre training as first prediction, the results revealed a significant of change with prediction when cognitive anxiety is high, it will increase the level of physiological arousal to drop academic performance with this test showed a significant increase ($p < .05$) in the variance from the linear to the full test model F (3, 32) = 3.367, $p < .04$, R^2 = -.174. F-test was performed on the R^2 increase to see if there was a significant increase in variance from the linear model to the full test model (Pedhazur, 1997). The same as second prediction, cognitive anxiety will have a negative relationship with academic performance when physiological arousal is high with (R = -.417). Concerning for post training as third prediction, the result show significant of change when physiological arousal is low, cognitive anxiety has a positive relationship to academic performance with (R = .469). This test revealed a significant reduce ($p < .05$) in the variance from the linear to the full test model F (3, 32) = 4.517; p = .01; R^2 = .220. The positive coefficients reflected lower physiological and cognitive was related in higher academic performance. In addition, for the both prediction found small coefficient of R^2 change (R^2 = -.174; R^2 = .220 respectively), which means that high anxiety has average 20% for the variation in low academic performance. Table 4.21 illustrated these results.

Table 4.21: Significant of changes between anxiety to academic performance

Measure	R	R^2	F-change	Sign (p) change
Pre (1^{st} and 2^{nd} prediction)	-.417	-.174	3.367	.04
Post (3^{rd} prediction)	.469	.220	4.517	.01

Note. * significant if $p < .05$, ** not significant if $p < .05$

4.5 Self-evaluation of Intervention Effect

Respondents in the training group asked to evaluate themselves about feeling, thought, and experience after learn the ten sessions of the biofeedback intervention program (appendix G). The data was collected using open-ended questions which are then transformed into quantitative data for analysis. The results were calculated based

on frequency and percentage. However, the scores have not been tested for reliability and validity with the instrument.

From the self-evaluation done by the training group after the pre post training, it shows that they have different feeling and condition about themselves. They described the changes in term of pre-training evaluation, study anxiety sources, physiological arousal, cognitive anxiety level, as well in their study performance. To ensure the respondents practice the techniques taught to them, they are asked a daily schedule for doing the exercise five-to-ten minutes, three times per day. This is to ensure that they can reduce their study anxiety. Currently, they have the motivation to learn, feel more confident, and more successful of their future. The result of self-evaluation explained as follows.

4.6.1 Pre Training Evaluation

The pre-training evaluation data related to the respondents' feelings, thoughts, and experiences is presented. Respondents in both groups have high anxiety level and low academic performance. Some of the problems that influence their study anxiety include lack of concentration, lack of motivation, lack of interest in subjects studied, unable to understand the contents of the subject, studying at the last minute, laziness, and some other related problems. Three subcategories were used to analyze the students' problems that influence their low academic performance. The subcategories are poor study skills (42.85% stated lack of concentration, 17.14% stated the inability to understand the contents of subjects, 11.42% stated lack of motivation, and 11.42% felt lack of interest in subject studied), lack of preparation (34.28% reported studying at the last minute, and 8.56% cited laziness), and other problems (57.14% cited busy with club activities, 11.42% felt inadequacy of facilities, and 5.71% mentioned financial problems). Table 4.22 presents the problems.

Table 4.22: Individual pre-training evaluation

Code	Subcategory	Units	Frequency	Percentage
1.	Poor study skills	Lack of concentration	15	42.85%
		Unable to understand	6	17.14%
		Lack of motivation	4	11.42%
		Lack interest in subject	4	11.42%
2.	Lack of preparation	Last minute study	12	34.28%
		Laziness	3	8.56%
3.	Other problems	Club activities	20	57.14%
		Inadequate facilities	4	11.42%
		Financial problems	2	5.71%

4.6.2 Study Anxiety Sources

The study was introduced to students to investigate the effect of anxiety on their academic performance. The majority of the respondents were not aware of the negative effects of anxiety. During the training they asked to recognize the sources of their study anxiety, and subsequently the results have been calculated based on frequency and percentage. From the results, 31% of the respondents stated that exam anxiety is the leading source of study anxiety; other sources are social anxiety (17%), presentation anxiety (17%), mathematics anxiety (14%), language anxiety (12%), and family anxiety (9%) but library anxiety is not a source of study anxiety among the training group. Table 4.23 present percentage of study anxiety among training group.

Table 4.23: Percentage of study anxiety among training group

Code	Study anxiety sources	Frequency	Percentage
1.	Exam anxiety	11	31%
2.	Social anxiety	6	17%
3.	Presentation anxiety	6	17%
4.	Mathematics anxiety	5	14%
5.	Language anxiety	4	12%
6.	Family anxiety	3	9%
7.	Library anxiety	-	-

4.6.3 Physiological Arousal

There is an 88% improvement in reduced physiological arousal as the respondents reported on the improvement of their respiration skills, are able to utilize diaphragm breathing and feeling comfortable, feel more relaxed and calm, ability to control heartbeats, are able to reduce headaches, and improvement in their physical health. These improvements are divided into three subcategories: reduction in breathing rate (including 94.28% was able to utilize slow diaphragm breathing, and 2.85% improved their respiration skills), feeling more relaxed (including 100% feel more relax, and 14.28% feel comfortable), improvement in their physical health (including 2.85% reduction in dizziness, 2.85% reduction of headaches, and 5.71% feeling of physical well being). Table 4.24 displays the results of physiological arousal.

Table 4.24: Self-evaluation of physiological arousal

Code	Subcategory	Units	Frequency	Percentage
1.	Reduce breathing rate	Be able do slow breathing	33	94.28%
		Improve respiration skills	1	2.85%
2.	Feel relax	More relax	35	100%
		Feel comfortable	5	14.28%
3.	Improve physical health	Reduce dizziness	1	2.85%
		Reduce headaches	1	2.85%
		Physical well being	2	5.71%

4.6.4 Cognitive anxiety

In cognitive anxiety, all of them (100%) are able to reduce the anxiety. The respondents show evidences on the ability to release their tension, overcoming their nervousness, controlling their emotions, feeling happy, and most of them changing into positive thinking. The findings can be divided into students are able to: reduce anxiety level (including 74.28% - release tension, 100% - reduce anxiety, and 48.57% - release

nervousness); release negative feeling (including 8.56% - release stress, 48.57% - control emotions, and 2.85% - reduce sleep disorders); improve positive feeling (including 80% - feel more confidence, 62.85% - feel calm, 2.85% - feel happy, 28.57% - improve self motivation, and 31.42% - think positive). The results are shown in Table 4.25.

Table 4.25: Appraisal of cognitive anxiety

Code	Subcategory	Units	Frequency	Percentage
1.	Reduce anxiety level	Release tension	26	74.28%
		Reduce anxiety level	35	100%
		Release nervousness	17	48.57%
2.	Release negative feeling	Release stress	3	8.56%
		Able control to emotions	17	48.57%
		Reduce sleep disorders	1	2.85%
3.	Improve positive feeling	More confidence	28	80%
		Feel calm	22	62.85%
		Feel happy	1	2.85%
		Self motivation	10	28.57%
		Positive thinking	11	31.42%

4.6.5 Academic Performance

The effect of the intervention has motivated the respondents to improve their study techniques. This is observed when the respondents are able to improve their study skills, increase their test scores, better manage their time, improve their concentration, able to study more effectively, feel comfortable in their study, reduce sleepiness during class, perform better during class presentation, have more confident to improve their study, and have better self-motivation to study.

Time management plays an important role in enhancing the respondents' academic performance. At the start of the training, the respondents were asked to list down their daily activities. The respondents were informed that one of the effective

ways to improve their academic performance is by spending two hours of self-study at their hostel for every hour of study in class reviewing the materials that they had studied earlier (Dalton et al., 2003). After learning to manage their time, 83% of the respondents have successfully improved their GPA, but 17% failed to show the improvement. The academic performance was classified into five subcategories: improvement in GPA (82.85%), decrease in GPA (17.14%), improvement in study skills (including 62.85% have improved their study techniques, 8.56% are able to handle given tasks, 28.57% have improved their concentration when studying, and 5.71% feel more comfortable to study), improvement in managing time (57.14%), other progress (including 42.85% have improved their test scores, 8.56% have reduced sleepiness during class, 8.56% have more self-confident, and 8.56% have reduced their presentation anxiety). The results are displayed in Table 4.26.

Table 4.26: Academic performance estimation

Code	Subcategory	Units	Frequency	Percentage
1.	Increased GPA	Increase GPA	29	82.85%
2.	Decreased GPA	Decrease GPA	6	17.14%
3.	Improved study skills	Improve study	22	62.85%
		Able to handle tasks	3	8.56%
		Improve concentration	10	28.57%
		Comfortable to study	2	5.71%
4.	Improved time Management	Able to manage time	20	57.14%
5.	Other progress	Increase test score	15	42.85%
		Reduce sleepiness during class	3	8.56%
		More self-confident	3	8.56%
		Reduce presentation anxiety	3	8.56%

4.7 Summary

This study has found significant sources of study anxiety which includes examination, social, presentation, mathematics, language, family, and library anxieties. These sources of anxiety can potentially create anxiety among University Malaysia Pahang students during their study. It is observed that the effect of intervention has produced significant difference in physiological arousal, anxiety level, and academic performance in pre post training between the two groups. The findings show that study anxiety intervention with biofeedback training is a suitable program to teach the students to reduce anxiety and improve their academic performance. Discussions and conclusion are presented in the next chapter.

CHAPTER 5

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents discussion on the findings of the study which includes summary of findings, significant sources of study anxiety, the relationship of the anxiety and academic performance, decrease of physiological arousal, reduction of cognitive anxiety, and improvement of academic performance. The conclusion is based on the whole of the study. The limitations and recommendations of the study for further research are also included.

5.2 DISCUSSION

The purpose of the study is to examine whether the effect of the intervention in reducing study anxiety is able to improve academic performance. The effects of intervention on physiological arousal, cognitive anxiety levels, and academic performance are measured. Then, the significant correlation of anxiety and academic performance are examined.

5.2.1 Summary of Findings

From the preliminary results, the study found seven sources of study anxiety that existed among university students. A survey was conducted to gather general information, such as study avoidance and general feelings of anxiety during study. Among the significant sources, exam anxiety is found to be a leading source; other sources are social anxiety, presentation anxiety, mathematics anxiety, language anxiety,

family anxiety, and library anxiety. Exam anxiety and social anxiety are two potential sources that can create more serious anxiety compared to other sources. Identification of study anxiety sources is needed in order to help students explore their self-resource in improving their academic performance. A significant correlation has been found that relate the high level anxiety among the students to their low academic performance.

In ten sessions, the students in the training group learned the intervention techniques to reduce study anxiety and improve their academic performance. The findings of a pilot study have found that study anxiety can be significantly reduced after six training sessions, but insufficient to improve academic performance. However, another study among young golfers found that ten sessions of Heart Rate Variability biofeedback training enhanced anxiety coping and other negative mood states in improving athletic performance (Lagos et al., 2008). Hence, six sessions of training were not sufficient for the students to learn and practice these intervention techniques.

The findings show that the training group reported a significant reduction in physiological arousal and cognitive anxiety compared to the non-training group. Furthermore, a significant improvement of academic performance was shown by the training group. The results were supported by the self-evaluation data in which the students cited that they feel more relaxed and calm, more self-confident, more motivated to study, and felt better than before. In short, all of the objectives and questions of this study have been answered. However, significant correlation of changes between anxiety to academic performance was found significant with a positive correlation. Consequently of seven hypotheses have been evaluated, and all hypothesis were accepted through the results obtained in accordance with the predictions. Moreover, the anxiety experienced by students affect on their academic performance and the biofeedback training intervention has helped reduce the anxiety to improve academic performance among engineering students at UMP.

5.2.2 Significant Sources of Study Anxiety

There have been a number of studies that provide an understanding of study anxiety sources among students. The study anxiety sources provide researchers with

findings on anxiety that lead to low academic performance. The sources include exam anxiety, language anxiety, mathematics anxiety, social anxiety, family anxiety, presentation anxiety, and library anxiety (Anderson, 2007; Puteh, 2002; Anastasia, 1994; Heather and April, 2008; Horwitz, 2007; Chen et al., 2002; Pan and Tang, 2005; and Ohata, 2005). A previous study was conducted to identify study anxiety sources among UMP students. Using one sample t-test, seven significant sources were identified that leads to study anxiety.

Exam anxiety was the leading source with t (1.769) = 172.298; p = .000; M = 25.75; SD = 4.066, and it shows that the students experienced anxiety while sitting for examination. Many of research carried out previously were concerned with anxiety that has an impact on test performance only under situations where the individual maintains a high level of cognitive test anxiety (Cassady and Johnson, 2002). Mandler and Sarason citing in Heather and April (2008) believed that high anxiety level interferes with test performance, while low test anxiety helps to improve examination performance. Other studies found similar results of anxiety interfering with students' performance on examination (Barbara, 2002; Harris and Coy, 2003; and McCraty et al., 2000). The highest score for exam anxiety was in Question 1: "How often do you feel anxious during examination due to the lack of preparation?" Students indicated that lack of examination preparation, in terms of not enough of study preparation created anxiety during examination. The findings were supported by Pecoraro (2006) who reported that students who are not well prepared for examination may have higher levels of task interfering worries during examination than those who are better prepared. Another research finding by Sansgiry et al. (2006) found more than two thirds of the respondents (69.3%) experienced some level of anxiety during examinations even though they thought they were well-prepared.

Social anxiety is considered as a significant source of study anxiety with t (1. 769) = 110.095; p = .000; M = 20.33; SD = 4.999. The highest score for social anxiety was in Question 24: "How often do you face difficulty to study when there are many friends in a room?" Too many roommates were considered a social anxiety making students feel difficult to study. The finding is consistent with Naomi (2007) and Cowden (2010), who cited the effect of social life as an important issue in study

anxiety, such as difficult relationship with roommate, problem with peers, and uncomfortable life in the hostel.

A survey found that class presentation was required to evaluate part of students' academic course (NUI Galway, 2008). Performing in front of a class, students, and lecturer is a difficult part of speaking in public that makes them feel anxious (Anna and Marion, 2008). The findings found class presentation as a significant source with t (1.769) = 123.651; p = .000; M = 16.91; SD = 3.684, making class presentation as a potential to create anxiety among students. Elliot and Joyce (2004) also found that anxiety is associated with giving presentation is a current issue among university students. High score for presentation anxiety was in Question 32: "How often do you feel that your heart beats very fast during class presentation?" Heart beating very fast is one of the symptoms of anxiety, due to lack of preparation. Murugesan (2006) suggested that to avoid presentation anxiety student should have adequate preparation and practice. Other researchers reported that 35% of the students surveyed indentified public speaking as a source of anxiety (Bishop in Elliot and Joyce, 2004).

Engineering students have affiliation with mathematics as a subject relevant for engineering curriculum as a language for describing physical, chemical, and other formulation in terms of mathematical enquiry (Willcox and Bounova, 2004, and Sazhin, 1997). The result established that mathematics anxiety as a significant source of anxiety with t (1.769) = 140.616; p = .000; and M = 16.60; SD = 3.178. High score for mathematics anxiety was in Question 16: "How often do you feel anxious when you cannot understand mathematics?" Mathematics being one of the more difficult subjects; students felt anxiety if they do not understand the subject. The subject requires high levels of concentration compared to other subjects in the engineering field (Sazhin, 1997); this possibly creates anxiety towards mathematics among engineering students. A study found response in mathematics anxiety to perceive as threatening them to self-esteem such as panic, tension, helplessness, fear, inability to cope, and physiological symptoms such loss of concentration and breathing difficulty (Uusimaki et al., 2004). For some students having to put up high levels of concentration means mathematic is a difficult subject for them. Having symptoms like fear, lost of interest, lack of

concentration, impatience, confusion, and tension are symptoms of mathematics anxiety.

Language anxiety was confirmed as a significant source of study anxiety with t (1.769) = 131.234; p = .000; M = 16.33; SD = 3.346, foreign language has the potential to increase anxiety among students. This finding was supported by Bai et al. (2009) who cited that language anxiety has been shown to be significant factor of learning process. High score for language anxiety was in Question 12: "How often do you feel anxious because of lack of confidence while taking language class". Students feel lack of confidence when using foreign language with the perception that lack of confidence creates anxiety. The finding described that language anxiety is a form of situation-specific anxiety experienced particularly in a foreign language context (Ying, 2008). Matsuda and Gobel (2003) claimed that language anxiety is a unique type of anxiety in foreign language such as speaking, listening, writing, and reading.

Family factor also contributes to the development of an elevated rate of anxiety disorders among students (Susan and Margareth, 2005). The findings have shown that family factor is significant as a possible source of study anxiety with t (1.769) = 79.026; p = .000; M = 11.12; SD = 3.728. High score for family anxiety was in Question 29: "How often do you feel that your family problems can increase your anxiety during study?" Family problems have the potential to create anxiety during study. Problems include parents' divorce, family problems, family pressure, childhood experiences, and low appreciation of students' achievements (Susan and Margareth, 2005). The home has a great influence on the students' psychological and emotional well being (Uwaifo, 2008). Family problems cause the students to feel inadequate exposure toward achieving high performance.

Students are required to use the library at some point in their study. However, the library has been identified as an obstacle to academic success among students (Ansari, 2009). The finding found that library anxiety is a significant source of study anxiety with t (1.769) = 61.271; p = .000; M = 9.52; SD = 4.087. The highest score for library anxiety was in Question 35: "How often do you feel embarrassed when you do not know how to use the library?" Library anxiety existed among UMP students. The

finding is supported by a previous study which reported that 75% to 85% of undergraduate students experience uncomfortable levels of library anxiety (Qun and Anthony, 2002). The Theory of library anxiety proposes that when students are confronted with the need to gather information in the library, many become so anxious that they are unable to approach the problem logically and effectively (Carlile, 2007).

5.2.3 The Relationship of Study Anxiety and Academic Performance

A significant correlation of anxiety and academic performance is of particular interest in a number of studies in area human performance or psychophysiology (McCraty, 2007; El Anzi, 2005; McCraty et al., 2000; and Anastasia, 1994; Luigi et al., 2007; and Sena et al., 2007). The relationship of anxiety and academic performance was examined by state trait anxiety inventory (STAI) and grade point average (GPA). The results show a significant correlation with p =.000, the correlation coefficient is r = -.284. With this finding, it is shown that there is a significant correlation between study anxiety and academic performance, with a small correlation coefficient. The result is consistent with those of previous studies that found a negative correlation between high levels of anxiety and low academic performance (Heather and April, 2008; Soler, 2005; McCraty, 2007; Luigi et al., 2007, and Sena et al., 2007). Another finding by El-Anzi (2005) described a positive relationship between high degrees of academic achievement and low anxiety. The finding is also supported by Ibrahim (1996), where anxiety plays significant role in students' learning and academic performance. A fair number of previous studies have also found a significant relationship between academic achievement and anxiety (El-Anzi, 2005). Researchers generally agree that high level of anxiety will lead to low academic performance. The results have proven that students who have high anxiety levels achieve low academic performance, such that those with anxiety level > 95 achieved academic performance < 2.00. Therefore, it can be concluded that there is a significant relationship between high level anxiety and low academic performance among UMP's students.

5.2.4 Evaluation the Effect of Biofeedback Intervention Program

Overall, the result of this study show that the development of biofeedback intervention program which consisted of ten sessions training had significant positive effect in reducing anxiety to improve academic performance among engineering students. In particular, respondents in the training group showed significant improvement from pre to post training in reducing physiological arousal, decrease cognitive anxiety, and academic performance enhancement. Further, the non-training group showed significant improve on academic performance but not for reducing anxiety. Similar significant results did not exist in the non-training group (Sutarto and Abdul Wahab, 2008).

The biofeedback intervention seen into two components are physiological techniques and cognitive skills. Physiological techniques focus on reducing physical symptoms of anxiety. Whereas cognitive skills were teach students to reduce anxiety by improving mental abilities. The positive effect of biofeedback intervention in reducing anxiety to improve academic performance are discussed below

a. Decrease of Physiological Arousal

The physiological arousal was measured by beat per minute, breath per minute, and Nijmegen questionnaire. Pougatchev and Pougatchev (2008) cited that physiological arousal of anxiety is related to heart rate and breathing rate as reaction of the body. Diaphragm breathing was chosen to produce relaxed condition to reduce anxiety level (Lehrer and Woolfolk, 2007; McCraty, 2000; and Johnson et al., 2009). In a similar study, Lehrer and Woolfolk (2007) found that arousal anxiety due to fast heartbeats can be decreased by lowering the respiration rate, through controlled respiration, and thus reducing the heart rate. The technique has been widely used with patients with anxiety disorders and results shows decreasing respiration and pulse rates, and increased alpha waves in the brain to produce feeling of calmness (Hall and Long in Prato, 2009). It was found that during the training session, the students' respiration rate decreased, while their peripheral skin temperature increased significantly (Prato, 2009). Slow breathing is indicative of people in relaxed condition (Pierini, 2010).

Relaxation technique was chosen to improve technique in reducing anxiety. According to Johnson et al. (2009), there are two particular techniques, deep breathing and relaxation, which have been shown to effectively decrease anxiety levels in individual who have difficulty relaxing in anxious situations. In another research, Prato (2009) cited that relaxation techniques are effective in reducing anxiety and activating the parasympathetic nervous system with decreased heart beat and respiration rates. Relaxation combined with visual relaxation is an effective technique to reduce anxiety and improve relaxed condition among participant in the training group. In visual relaxation students learned to improve concentration by focusing thoughts on one particular image for a duration of five minutes.

Physiological arousal was measured in the last minute of each training session of the training group. The purpose was to examine changes in time of the respondents' physiological arousal, and pre post training was designed to examine the differences in the effect of the intervention between the groups. The training group learned the intervention techniques to reduce heart rate and respiration rate in the biofeedback training. On the contrary, the non-training group received no intervention whatsoever. Educational research on biofeedback suggests that biofeedback training can help students learn to prevent unpleasant and uncomfortable effort, while enhancing emotional intelligence as well having greater capacity for learning (Stephen, 2001). Repeated measure ANOVA found significant difference in time changes of heart rate and respiration rate of the training group. Apparently, the training group show significant difference in pre post training in heart rate, respiration rate, and Nijmegen score compared to that of the non-training group. Self-evaluation data reported that 94% of the training group were able reduce anxiety with diaphragm breathing, and 100% feel relaxed at the end of training. The differences in respiration rate were not found in the non-training group.

These findings are consistent with those of the previous research which found breathing as effective in reducing physchophysiologycal disorder among students (Sutarto and Abdul Wahab, 2008; and McCraty, 2000). They found that the students in the experimental had significantly increased cognitive task in pre post brief training in heart rate variability. Hence, biofeedback training is effective for students and

consistent with Wilrich (2007) who says that biofeedback program offered by HeartMath helps students regulate their heart rate in terms of emotional response to stress. Researchers at HeartMath have found that Biofeedback training is a powerful tool to assist students in using emotion-focused techniques effectively and learning to self- generate increased coherence (Arguelles et al., 2003). The training aimed to support, motivate, and emotionally engage students who lack a healthy social and emotional environment (McCraty, 2005).

b. Reduction of Cognitive Anxiety

The training group showed a significant difference in cognitive anxiety in the pre post training. They learned diaphragm breathing, relaxation, visual relaxation and other skills to improve their confidence in their study. Cognitive skills are powerful in reducing intense anxiety and panic by focusing on a few minutes on diaphragm breathing (Westermeyer, 2002), and also Gill et al (2004) confirmed that relaxation techniques could reduce cognitive anxiety. Cognitive anxiety level was measured by State, Trait, and Study Anxiety Scale. The cognitive anxiety is addressed by State and Trait (STAI) instrument, meaning that high levels of state and trait scores determine high level of cognitive anxiety (Spielberger, 1983; Cassady and Johnson, 2002; and Prato, 2009). The training group showed a significant difference in the reduction of State, Trait, and Study Anxiety Scale (SAI) in pre post training compared to the non-training group.

The instruments were administered to the training group at the beginning and the end of the study to compare the effect of intervention in reducing study anxiety. Reliability and validity test of the instruments were already tested in the pilot study. The consistencies of the reliability test are as follows: State (.84), Trait (.76), and SAI (.89). The findings were supported by Nunnally (1978) who recommended that the instruments used in basic research should have a reliability of Cronbach Alpha score .70 or better. The training group experienced a slight decrease in cognitive anxieties and significant differences were found in all the measurements. These findings are in line with Prato (2009).

The data obtained from the self-evaluation showed that 100% of the students reported reduction of anxiety level, with high level in pre-training to low level in post-training, feel more confident, and showed other positive improvements such as being able to release tension, reduce nervousness, think positively and control emotion. Similarly, previous research has found that cognitive symptoms of anxiety include fear of making mistakes, feelings of inadequacy, worrying about things happening, and studies have indicated that high levels of anxiety are related to low levels of confidence (Miller, 2009).

Accumulation of the significant values, the effect size of the State, Trait, and SAS flexibility of the training group, where each parameter was reported with a large $\acute{\eta}^2$ > .25; this signify that the effect of intervention with biofeedback training was definitely a substantive finding. Other researchers have found that biofeedback was effective in improving performance among students; Al Shamari (1991) suggested that biofeedback is effective in decreasing students' EMG level, students feel more relaxed at the end of the biofeedback training as indicated by the decreased anxiety scores on Trait but not significant on State (Hechman, 1998), and biofeedback has assisted self-regulation training to decrease anxiety level among college students (Champbell, 2005).

c. Academic Performance Improvement

Analysis of results shows a significant improvement in the academic performance of the two groups as both groups show increased GPA. That the non-training group improve their academic performance is probably influenced by other variables that cannot be controlled in this study, such as self-awareness to enhance learning. This is supported by previous studies' reports that three primary factors influence academic performance which includes individual effort and involvement, peer interaction, and faculty contact for engineering students (Amenkhienan and Kogan, 2004). Carroll and Garavalia (2004) cited that successful academic performance is dependent upon effective studying and motivational strategies. Apparently, the training group prove 25% improvement of academic performance compared to 7% improvement of the non training group; the mean score of the training group was M_1 = 2.65 from M_2 = 2.11 and that of the non-training group was M_1 = 2.35 from M_2 = 2.20 to. Data found

that student are better able to allocate their time for study than before, as time mismanagement can be an obstacle to improving academic performance.

Sansgiry et al. (2006) cites that higher academic performance may be achieved by balancing time management and study techniques effectively. Students in the training group experience 83% improvement of academic performance and only six students dropped-out of the program during the semester with reasons that have been cited in the findings. In other findings respondents showed evidence of improvement in their study skills, increased test score, being able to manage the time, improved concentration, being able to study more effectively, feeling comfortable in study, reducing sleepiness during class, able to perform better in class presentation, being more confident to improve study, and having more self-motivation to study.

The result is consistent with Moss (2003) who stated that biofeedback was a useful tool and simple to use with training procedures available for making students learn and apply self-regulation skills to enhance academic performance. Similarly, previous findings on biofeedback training also showed the following achievements: improve mathematics performance as well task behaviour, resulting in increased test scores on reading and mathematics among high school students (McCrathy et al., 2000); improve student achievement index in test performance as well effective reduced test anxiety (Prato, 2009); enhance study skills when students learned to level mind/body activity (Stephen, 2001). Institute of HeartMath present "TestEdge" intervention in overcoming stress by using "Frazee Frame" with breathing exercise to improve test performance, resulting in increased mathematics and English scores among high school students (An overview of research, 2000).

d. Assessment of Theoretical Model

The last findings is fairly consistent with prediction made by the proposed model (see figure 2.2) which suggest that anxiety has an effect on performance. The Catastrophe model is a three dimensional model to predict the interactive effects of cognitive anxiety and physiological arousal upon performance (Fazey and Hardy, 1988). Similarly Robb (2005) cited that cognitive anxiety and physiological arousal has been

recognised as anxiety components that the performance influences. Individuals who are anxious will achieve low performance and adaptability to change task demands. In short, student with high anxiety will achieved low academic performance. According to the theoretical model, this study revealed the predicted of significant correlation between changes in anxiety to performance can be predicted including when cognitive anxiety is high, it will increase the level of physiological arousal to drop performance, cognitive anxiety will have a negative relationship with performance when physiological arousal is high, and when physiological arousal is low, cognitive anxiety has a positive relationship with performance. The ability to reduce cognitive anxiety and physiological arousal is an important component to cope with anxiety in order to improve academic performance.

Withstanding significant different as in reduced physiological arousal and cognitive anxiety, the training was also significant in improving academic performance. Results concur with the prediction on Catastrophe model by Fazey and Hardy (1988) that the finding showed a significant correlation between change refer to the first prediction when cognitive anxiety is high, it will increase the level of physiological arousal to drop performance in the pre training. Moreover, cognitive anxiety has a negative relationship with performance when physiological arousal is high, as expected in the second prediction. Concerning in the post training, the positive correlation coefficients reflected when physiological arousal is low, cognitive anxiety has a positive relationship with performance. Some of the prior research was examining the relationship of physiological arousal and cognitive anxiety to performance (Fazey and Hardy, 1988; Bridges and Knight, 2005; and Robb, 2005). Bridges and Knight (2005) found that significant positively correlation between cognitive and performance (r = .76, p = .000, n = 12). However, high anxiety has 20% for the variation in low academic performance. 80% of other variations in the low academic performance is influenced by other factors are excluded in this study.

Few interesting studies had applied the Catastrophe model to evaluate students' performance. Stamovlasis (2008) has used for tenth-grade students to examine the working memory overload which accounts for discontinuities in students' performance. Geuastello (1987) used the model in an application to change the academic performance

level. Gueastello was observed 272 freshmen at a technical university. Result had show changes in grade point average from high school to college. Staman (1982) examined the catastrophe model with students' performance and communication toward teacher expectation. The result showed student had high performance level subsequently class responses was deemed favourable as the expectation was correspondingly high.

Ultimately, the previous works explored the applicability of Catastrophe model for testing hypotheses in many field. However, there are no comparable studies that assess the Catastrophe model to observe the effect of biofeedback intervention program on reduced anxiety to improve academic performance for engineering students. However, several studies were used to understanding affiliation of anxiety and performance in sports psychology to illustrate the relationship. Fazey and Hardy (1988) conducted research to examine the Catastrophe model of anxiety and performance among eight basketball players. The basketball players required to perform under low cognitive anxiety and physiological arousal that was manipulated by physical exercises. Result show a significance confirmed with $p < \cdot 002$ by means of decreasing arousal and cognitive anxiety condition. Another finding by Robb (2005), who that was evaluated of the relationship between physiological arousal and cognitive anxiety among golfers' performance. Result was found low performance increases worries among golfers. Bridges and Knight (2005) investigated on anxiety (made up of cognitive component and physiological component) to predict athletics' performance. Respondents were tested for physiological anxiety (measuring blood pressure and heart rates) and cognitive anxiety (self report questionnaire) during spare time of competition. Linear regression was used to determine a significant positive relationship between cognitive anxiety and performance among basketball player. Result showed a significant relationship of low cognitive anxiety and high performance among basketball players. The authors reported that low level of physiological and cognitive are related improvement of performance in multiple tasks domain.

As the most prominent outcome of biofeedback intervention program is improvement academic performance, an evaluation of reduced anxiety measures was done as well. In addition, the improvement of academic performance was found where the physiological arousal and cognitive anxiety is reduced. Furthermore, academic

performance makes particular demands on motivation, relaxed condition, memory, planning and strategies. As a conclusion the study had supported the Catastrophe model to examine the effect of biofeedback intervention program in reducing anxiety for the improvement of academic performance among engineering students.

5.3 CONCLUSION

Previous studies cited that high level of anxiety have negative effect on students' academic performance. Biofeedback training is a specific treatment modality with practiced relaxation and effective training to reduce anxiety to peak human performance (Page, 2004; Schwartz and Andarsik, 2003; Thurber, 2006; and Brauer, 1999). As a preliminary study, a survey was conducted to identify study anxiety sources. A total of 770 students completed the survey questionnaire. The result found seven significant sources that exist among students in which exam anxiety is a leading source; other sources are social anxiety, presentation anxiety, mathematic anxiety, language anxiety, library anxiety, and family anxiety. The results were supported by prior studies that the study anxiety sources existed among university students (Anderson, 2007; Puteh, 2002; Anastasia, 1994; Heather and April, 2008; Horwitz, 2007; Chen et al., 2002; Pan and Tang, 2005; and Ohata, 2005). Identification of study anxiety sources seek to design the intervention materials for biofeedback training.

A total of 205 students with low academic performance completed the test. The test was measured by STAI to assess anxiety level and grade point average (GPA) as academic performance prediction. The result show significant correlation with $p = .000$, coefficient correlation yield $r = -.264$. It can be concluded that there is a significant relationship between high level anxiety and low academic performance among UMP students. The results are consistent with previous studies which found a negative correlation between high levels of anxiety and low academic performance (Heather and April, 2008; Soler, 2005; McCraty, 2007; Luigi et al., 2007, and Sena et al., 2007).

Study anxiety intervention is developed as training materials specifically to reduce study anxiety and improve academic performance. Related of the study, this intervention took two approaches; the first being physiological therapy consisting of

slow diaphragm breathing, relaxation exercise, and visual relaxation. The second approach being the cognitive therapy consisting of study anxiety coping skills, resource management skills, learning strategies skills, time management, and study skills. These techniques were developed to improve academic performance by reducing anxiety level. Cognitive skills for managing anxiety are powerful means of reducing intense anxiety and panic (Westermeyer, 2002). However, study anxiety sources were not measured in the biofeedback training, other than to help students in exploring their self-resource of study anxiety in improving their academic performance. The findings show that the training group report significant reduction of physiological arousal and cognitive anxiety compared to the non-training group. The physiological arousal display decrease of beat per minute, breath per minute and Nijmegen score after the respondents learning the intervention during the ten sessions of biofeedback training. The results are consistent with prior studies that the technique had been extensively used to reduce anxiety disorders with results showing decreasing respiration and pulse rates to produce feeling of calmness during training session (Lehrer and Woolfolk, 2007; and Prato, 2009). The training group also reported significant decrease in state, trait and study anxiety scale, as opposed to the non-training group. In the pre post training, the training group showed better improvement than the non-training group. The research findings were equivalent with the previous studies that high level of state and trait scores determines high level in cognitive anxiety (Spielberger, 1983; Cassady, 2001; and Prato, 2009). Furthermore, a significant improvement of academic performance was shown by the training group. After the final examination, students in the training group reported increases in their GPA. The training group showed 25% improvement in their academic performance; however the 7% improvement shown by the non- training group supported the findings of Carroll and Garavalia (2004) who cited that successful academic performance is dependent upon effective studying and motivational strategies. The results were supported by self-evaluation findings that students in the training group reported feeling more relaxed and calm, being more confident, having motivation to study, and feeling better than before.

From the discussion above, we can conclude that all seven hypotheses were accepted due to the following findings related to UMP students: the existence of significant study anxiety sources, the significant correlation of anxiety and academic

performance, the significant difference in pre post training in physiological arousal among training groups, the significant difference in pre post training in physiological arousal between groups, the significant difference in pre post training in cognitive anxiety between groups, the significant difference in pre post training in academic performance between group, and a positive relationship of changes in physiological and cognitive towards academic performance. Hence, intervention is essential to improve students' academic performance. To conclude, the study anxiety intervention is a beneficial tool to recommend to students as an academic probation program to learn self-regulation in reducing study anxiety, not only to improve academic performance but also to achieve overall well being. In addition, the study accepted the Catastrophe model to examine the effect of biofeedback intervention program on anxiety among engineering students.

5.4 LIMITATIONS OF STUDY

The study was limited in several aspects that would decrease the capability to overview in other situations. This is due to the many factors that influence on human feelings, thoughts, and experiences related with their anxiety level as well as academic performance.

The first limitation is the sample size itself. The sample, consisting of 70 engineering students was considered small. Moreover, the sample pool consisted of only a fraction of the 3rd semester engineering students from one university, which is Universiti Malaysia Pahang. Another reason was that some of students are unavailable to participate in this training.

The second limitation is the insufficient number of the devices required for the training. In order to achieve slow diaphragm breathing, the students had to follow the pacer through watching the monitor screens; ideally each student should be provided with his own device. Student also had the task to perform home relaxation exercise and to record the results on the form given (appendix I). Another limitation is that the non-training group attended only the pre post test. This decision was taken based on the results of the pilot study, where it was found that the non-training group has reduced

their anxiety level of state, trait, and SAS scores even without intervention. Since this study had not used the placebo effect, it was unnecessary for the non-training group to attend the training sessions more frequently.

In summary, the biofeedback training is one of the new approaches in reducing study anxiety to improve academic performance in university students. The findings show that respondents have learned successfully to reduce their anxiety and enhance their self-regulation toward improving their academic performance in third semester.

5.5 RECOMMENDATIONS

There are many enquiries left unanswered by the study in trying to identify study anxiety sources, examine the relationship of anxiety and academic performance, and estimation of intervention program. The study did not determine the effect of gender, race, and many other variables such as academic and non-academic factors. Recommendations for further research include the following: continue to explore the other sources of study anxiety as well the demographic effect on study anxiety sources.

Researchers have found the relationship of anxiety and human performance in many fields. However, limited number of research has been conducted to examine the effect of study anxiety and academic performance among university students. This study has found small coefficient correlation between study anxiety and academic performance. Further research could also be conducted using a large sample size to determine the effect of study anxiety on academic performance. A large sample could strengthen the statement on the effect of anxiety on academic performance.

In the estimation of intervention program of this study, the researcher is both the trainer and the evaluator, since no proficient trainer or evaluator is available in the university. The trainer, therefore, must be knowledgeable in the field of psycho-physiological treatment and must be certified in biofeedback training. It is important to measure the impact and effectiveness of intervention program in order to identify the strengths, weaknesses, and make improvements when needed. The methodologies necessary for adequate evaluations of training programs have received considerable

attention in the training literature. Therefore, these techniques could be used in research related to evaluation of diversity training programs. It is further suggested that a research assistant with the relevant qualifications should be appointed as the trainer and the evaluator.

The university and students need to understand and help each other if they are to solve their shared problems so as to ensure that members of each new generation acquire the skills, knowledge, and understanding that will enable them to have a successful and rewarding life. The limited evidence and device to date suggest that diverse workforces are likely to incur short-term costs, although such intervention effects may eventually be recouped by longer-term benefits.

Another recommendation to further improve the research includes the following: adequate number of devices for measuring physiological arousal should be provided; more effective intervention programs could be conducted through cooperation with other educational institutions; and to explore the impact of diversity of programs in various context and design. The general point, however, is that academic performance would have been easier to improve or intervention program be successful if they were supported by a stronger research base linking workforce diversity to various interventions and outcomes.

5.6 SUMMARY

The study proves the importance of study anxiety intervention program to improve academic performance. The findings show seven sources that were significant study anxiety sources among university students; there is significant correlation between high study anxiety and low academic performance; intervention program was significant in reducing study anxiety to improve academic performance. The study proposes the intervention program to be adopted as an academic probation to benefit students. However, the study is limited in several aspects, namely the small sample size and inadequate number of devices; this would decrease the ability to generalization concern in other situations.

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APPENDIXES

APPENDIX A:

STUDY ANXIETY INTERVENTION:

Academic Performance Enhancement Tool

Prima Vitasari

Technology Management

University Malaysia Pahang

2009

Table of content

Introduction

Spielberger defined anxiety as the subjective feeling of tension, apprehension, nervousness, and worry associated with arousal of the nervous system [6]. Sometimes anxiety includes excessive worrying, a nagging sense of fear, restlessness, overly emotional responses, negative thinking, and defensiveness. Once a person gets locked into a pattern of anxiety, it can be hard to break. Learning how to modulate or turn off chronic anxiety responses is life changing. Little is known that possible association between high level of anxiety and low academic performance among students. Researchers have been done looking at the correlation of anxiety sources and the effect of academic performance, student with higher level of anxiety will have lower academic performance [9 & 10]. High level anxiety will reduce working memory, impairs concentration, and reasoning.

A survey of 770 freshmen was carried out to identify of study anxiety sources, namely, exam anxiety, class presentation anxiety, mathematics anxiety, language anxiety, and social anxiety. But students are not usually aware of having anxiety problems while studying and so do not seek help. Meanwhile, studies show that the incidence of mental illness on campuses is on the rise. The aim of the biofeedback training is to teach techniques in reducing study anxiety and improving students' academic performance.

The training is supported by study anxiety intervention; the intervention is used to teach the students learn in managing their study anxiety, to expand their awareness and increase control of their body in order to improve their academic performance. These techniques are designed to prevent the development of intervention by increasing study anxiety resilience and promoting positive coping skills to improve academic performance. The study anxiety intervention (SAI) includes module and protocol, the module is aimed to give practical guideline in reducing study anxiety as well to handling the time leading up to study. Desensitization protocols include breathing exercises, releasing tension, visual relaxation, and positive suggestions.

July 11, 2009

vita Education Services

Author

APPENDIX B:

Training Module

Appendix K

Email from The HeartMath

Wed, February 10, 2010 7:52:19 AM

RE: Re:

From: Annette Deyhle
<annette@heartmath.org>

...

View Contact

To: vita Sari <vyetha@yahoo.com>

Dear Vita,

I looked through your anxiety program, and I think it done well.

At the Institute of HeartMath , we have a slightly different technique though. We think it is more effective. The method is called: Quick Coherence. See the description in the link.

http://www.heartmath.org/about-us/quick-coherence-technique-for-adults.html

We believe, that the biggest positive shift to being less stressed happens, when remembering and FEELING a positive feeling.

I saw that you suggested something similar, with remembering a nice place (ocean etc.).

The steps we suggest are:

1. Heart focus. Bring your attention to the area of your heart
2. Heart breathing: imagine inhaling and exhaling through the area of the heart to a count of 5seconds (5 seconds inhale and 5 seconds exhale). Breathe as deeply as comfortably possible.

3. Heart Feeling. Remember a feeling of love, gratitude, appreciation. A favorite place, pet, child…. Anything which makes you FEEL positive emotions. It is important to feel positive emotions, not just to think about it.

Research at HeartMath as shown that the positive feeling is the most effective way to help people shift their emotions.

We usually say, it's best to practice three times a day (morning afternoon and evening) for ca. 10 minutes. It usually takes 6 weeks to completely shift the stressful behavior and to form a new habit of better dealing with a stressful situation. But this depends on the individual (it could be more than 6 weeks).

I hope this helps.

Let me know if you have any questions and good luck with your intervention,

Annette

APPENDIX C

Survey Questionnaire

Dear participants,

This survey is being conducted for preliminary study of my PhD study at Faculty Manufacturing Engineering and Technology Management Universiti Malaysia Pahang. The survey is to identify the study anxiety sources. Study anxiety sources are source that create your anxiety during study. The questionnaire is consisting for **40 items** and I ask you to fill this questionnaire entirely.

Your participation in this survey is completely **voluntary**. Protect your confidentiality by answering the questionnaire anonymously. Your response on this survey will have **no impact on your study and personal record.** No one will know how you answered the questions because we will never report findings on an individual basis.

The questions in this scale ask you about your feelings, experiences, and thoughts during learning process. Remember that your answer can never be matched up with your name, so **please answer the questions a truthfully as possible**. For each question choose one of the following alternatives.

I appreciate your participation! Your feedback will help the study in identifying sources of study anxiety among Universiti Malaysia Pahang students.

RESPONDENTS' INFORMATION

1. Gender

Male ○

Female ○

2. Faculty

FKKSA ○ FKM ○

PLEASE CHOOSE AND SIGN (√) THE OPTION RELATED WITH YOUR FEELING, EXPERIENCES, AND THOUGHT ABOUT ANXIETY DURING STUDY

Alternative of questions: